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Manager and Secretary: E. S. MIDDLETON.

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

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Electricity Supply in 1925-26.

LAST week the portly volume of statistics regarding electricity supply undertakings, which has now become an "annual," was issued by the Electricity Commissioners, covering the period 1925-26*; it is a trifle late, compared with the Return for 1924-25, which appeared in November, 1926, but we presume that every effort is made to hasten production—and we know well how difficult it is to secure such information promptly from the managers of electrical undertakings.

The first Return covered the three years 1920-23, and the second two years, 1924-25; the present issue deals with one year only. Like its predecessors, the volume before us is a mine of information, which is given both in tabulated detail and in summarised form, the arrangement of the contents being generally similar to that of the earlier Returns. The price has been appreciably reduced, and cannot be regarded as excessive in view of the value of the work, which ought to be in the hands of everyone interested in the electricity supply industry.

The statistics given in the introductory memorandum in many cases show those of the previous year in parallel column, indicating the progress made in the interval. They show that at the end of the period 1925-26, the generating plant installed in the stations of authorised undertakers, numbering 491, had an aggregate capacity of 4,421,602 kW, representing an increase of about 700,000 kW; of this increase, 124,000 kW was accounted for by re-rating of existing plant, but even then, the capacity of the additional plant installed was nearly twice as great as the average during the preceding five years.

The energy generated increased from 6,022 to 6,618 million kWh, or about 10 per cent., local authorities producing about two-thirds of the total. Steam was the source of 98.2 per cent. of the output. Energy sold amounted to 5,606 million kWh, compared with 5,097, an increase of 11 per cent. Compared with 1921-22, the aggregate increase amounted

* Return of Engineering and Financial Statistics of the Electricity Commission. H.M. Stationery Office; price 12s. net.

to 105 per cent. for lighting and domestic purposes, and 79 per cent. for power; the former accounted for 22.2 per cent. of the total sales, and the latter for 67.1 per cent., traction being represented by 9.1 per cent. Out of 523 undertakings, 26 sold from 200 to 300 kWh per head of population, and 21 sold over 300; in the aggregate, on the basis of a population of 43.8 millions in 1925, authorised undertakers sold 128 kWh per head of population, as compared with 82 in 1920-21. These figures do not take account of the large supplies generated for industrial purposes by privately-owned plant, which were estimated some years ago at about 100 kWh per head.

The total load connected was 170 watts per head, and the maximum load recorded was 70 watts per head, showing a ratio of about 2½ to 1; the ratio of the maximum load to the plant installed was 100 : 173. The average fuel consumption per kWh generated was 2.43 lb. of coal or equivalent, showing a satisfactory improvement; since 1920-21 the output per ton of coal had increased by no less than 41 per cent.

The cost of generation in 1925-26 averaged 0.40d. per unit, of which coal accounted for 0.24d., and the total working cost per unit sold was 0.94d., whilst the average price obtained was 1.66d.

It will be remembered that, according to the Weir Committee, reporting in May, 1925, "under existing conditions of individual development, the utmost that could be expected by 1940 would be a reduction in the average price per unit from 2.047d. to 1.5d." It was not expected to fall below 1.75d.—why, we know not. That forecast was based upon data for 1923-24; in two years, then, the average price was well below the "probable" limit, and had fallen through 70 per cent. of "the utmost that could be expected by 1940"—and that without the aid of any new Act. It certainly appears that the electricity supply industry was doing very well in 1925-26.

Engineering Visits Abroad.

For very many years past the well-known engineering company, Mather and Platt, Ltd., has been foremost amongst British concerns in adopting a thorough-going and enlightened policy regarding export trade. It will be remembered that the late Sir William Mather was one of our most consistent and regular travellers in foreign markets, and the products of the concern had a very extensive circulation there in consequence. This long-established reputation is being maintained to-day, as the chairman of the company, Mr. L. E. Mather, stated in his speech at the annual meeting reported in our last issue. Slack trade at home and keener competition than ever led to slight reduction in profit, but these did not prevent the company from paying the same dividend and bonus as in the previous year. The company is not dissatisfied with its trade with Russia; it has sent a technical representative to Moscow to remain there for some months, and in addition Mr. Mather has recently personally paid visits to East Africa and the Sudan, from which business is expected to result.

We wish, however, to direct special attention to the point on which Mr. Mather closed his speech. It is one which should be read by all British public authorities at home and overseas with sympathetic consideration. By public authorities we believe him to mean not merely municipal and other public officials, whose departments have engineering requirements from time to time, but committee men, councillors, directors of companies and others who have power to influence the course of orders, whatever may be the recommendations made to them by their engineers. Municipal electrical engineers have sometimes to go to the Continent to inspect plant or works; this is a very well-known practice which is sometimes regarded as indicating the possibility, if not probability, that orders will go abroad at a later stage. Mr. Mather's suggestion is for visits of another character. He asks that public authorities should give their support to British manufactures, and that in order that they may be assisted to exercise their discretion in this way, they themselves should make a thorough study of conditions in competing countries before awarding contracts. When corporation electric plant orders are under discussion and the arguments are forward in favour of accepting a foreign tender, there is frequently one objector who asks questions regarding the industrial conditions obtaining in the competing country. The B.E.A.M.A. has reported upon such points again and again, and has made good use of the information, but why should it rest with them to do such a thing? Would it be out of place if the I.M.E.A., or the Municipal Corporations and some other similar bodies had a complete investigation made for themselves? They might obtain first hand and unbiased information regarding the difficulties of British manufacturers and think a little more conscientiously concerning their responsibility to British industry and British workmen.

Sir Philip Dawson, M.P., asked some very pertinent questions bearing on plant purchases abroad in the House of Commons last week, and these, together with the replies of Colonel Ashley and Mr. Neville Chamberlain, will be found in our Parliamentary Section to-day.

Industrial Lighting.

We have referred previously to the recently opened Home Office Industrial Museum in Horseferry Road, Westminster, which is the only one of its kind in this country, and well deserves a visit. One interesting feature that is, perhaps, not generally known, is the special attention that has been devoted to illumination. Not only is the general lighting of the Museum arranged on model and up-to-date lines, the arrangements being shared between gas and electricity, but there is also a series of cabinets in a section of the Museum designed to illustrate fundamental principles in industrial lighting. This exhibit received chief attention in the address given by Mr. H. C. Weston, on the occasion of the visit of members of the Illuminating Engineering Society, on February 17th. There are cabinets illustrating the effect of glare, the influence of illumination on the rate of perception, and the importance of the position of the light in relation to the work. Especially striking are two exhibits illustrating the amount of light wasted by dusty lamps and reflectors, and the influence of the colour of surroundings on the available illumination. Many of these little exhibits can be manipulated by the visitor, so that he can himself adjust and witness the changed conditions. The inclusion of exhibits of illumination as an essential element in the health and safety of workers is a gratifying instance of the sympathetic interest taken by the Home Office Factory Department in illuminating engineering.

The Glasgow Blunder.

As reported elsewhere in this issue, the Glasgow Electricity Committee has set up a new "Committee of Inquiry" to investigate the matters brought to light by the first "Committee of Inquiry." This decision, says our local correspondent, is not likely to satisfy the public. It is pointed out that technical questions are involved on which the advice of impartial experts would have been valuable; yet the Committee decided to take no action to that end.

In a leading article the *Glasgow Herald* says: "If the Corporation had been anxious to restore public confidence in the administration of its affairs, it would have taken other means of setting the Electricity Department in order than by entrusting the duty of formulating proposals for reorganisation to the committee so closely concerned with the revelations which have brought the city unenviable publicity. But it is determined to carry on in its own way, notwithstanding the strong feeling in the community that a better way could have been found." In view of the fact, so fully appreciated by the citizens, that the report arraigned the Electricity Committee itself, the procedure adopted is almost farcical.

Railway Electrification.

A comprehensive review of the general methods in vogue for the protection of electrical rolling-stock equipment, with suggestions for various improvements with a view to minimising danger and avoiding delays.

By E. H. CROFT, A.M.I.E.E.

IT is not uncommon for the circuit breakers or fuses protecting the main-motor and auxiliary circuits on electric rolling stock to fail to clear when operating, due to some fault, resulting in continued arcing until the supply is interrupted at the sub-station or feeders. Further, the passengers may be subjected to definite danger, especially in underground railways. Electric railway equipment protection is much more difficult than on industrial systems; the auxiliaries are connected directly across the same points, which may feed motors of up to 300 h.p. each, and the length of cable involved from the point of feed is relatively small.

Fig. 1 represents a simple form of protection utilised on many present-day low-voltage earth-return systems. In the case of an uninsulated return, the fuses and circuit breakers indicated are duplicated, one of each being placed in a similar position on the negative pole. Slight modifications are also required to the power circuits, but these are not within the scope of this article. In many cases, the main fuses are situated in the apparatus compartment; although difficult to avoid, this is decidedly bad practice, as it leaves certain lengths of cable unprotected within the compartment, or, in some cases, the driver's cab, which is somewhat dangerous and gives a feeling of insecurity to any driver with some electrical knowledge.

It will be seen further that there is no other form of protection, neglecting the shoe fuses, for the auxiliaries beyond the respective circuit fuses. This is extremely dangerous, as it brings an entirely unprotected auxiliary cable into the machinery compartment. It will thus be seen that whereas two lines of defence are introduced for the main motors, only one serves for the auxiliaries, which is perhaps somewhat absurd. The main circuit breakers are capable of rupturing many thousands of amperes without damage, yet engineers in the past have considered it necessary to provide equipment fuses as well: at the same time a small 15- or 20-ampere cartridge fuse on the auxiliaries is left without any additional protection at all. If the auxiliary fuses were manufactured to clear any "short" that came upon them, they would be too bulky and costly to be considered. To overcome this difficulty the writer has always recommended the use of main auxiliary fuses, or, alternatively, a circuit breaker of large capacity and capable of clearing any short circuit that may come upon it, with auxiliary-circuit fuses of a cheap industrial type which will function satisfactorily on the majority of faults.

In fig. 2 the system of protection often adopted for d.c. equipment for from 1,500 to 3,000 volts is indicated in a simple form. The auxiliary circuits are generally protected by special fuses of the expulsion type, connected up in pairs or three's and interconnected with resistances so that the short-circuit is broken in stages. In addition, each h.p. auxiliary machine has a separate special fuse; in some cases the fuses are replaced by circuit breakers. The main circuits are quite often only protected by means of the line switches LS_1, LS_2, LS_3, and LS_4, which are opened on overload or short-circuit by means of overload relays, one each of which is usually included in each motor circuit; it is common practice to introduce one in the trolley circuit as well. This arrangement operates with reasonable satisfaction.

A common method of protection utilised on single-phase systems of between 6,000 and 15,000 V is shown simply in fig. 3. When tripped, the oil switch cuts off the supply of energy to the whole locomotive. If a battery is in existence on the locomotive, the lighting can be taken from this when the switch is open. The writer, however, considers that any ordinary overload on the motors could be cleared on the l.p. side without tripping out the h.p. switch.

Fig. 4 depicts a form of protection which has been adopted for h.p. single-phase motor coaches. In this case an entirely separate transformer is utilised for the auxiliaries and is fed through a h.p. fuse. The main motor transformer is fed through a fuse and an oil switch, the fuse being the main protection adjacent to the line. This operates perfectly satisfactorily, and although the fuses burst occasionally, there is no danger, as they are encased in a suitable ironclad cubicle. Ironclad gear is used almost without exception on the higher voltages, but for 600-V schemes there is a very considerable difference of opinion as to the desirability of ironclad gear for non-earthed-return systems.

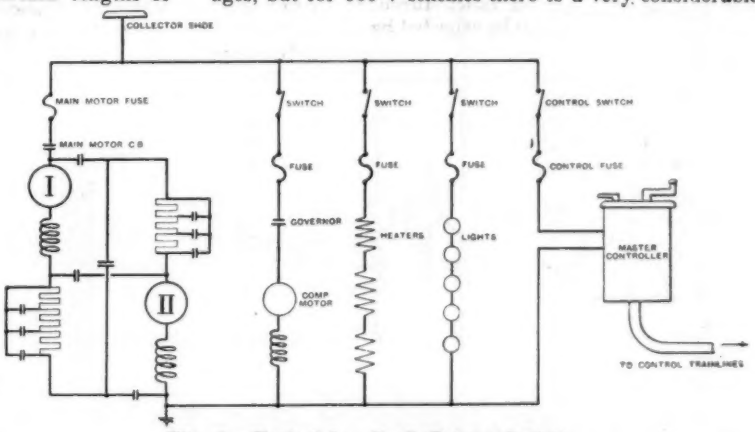


Fig. 1.—Typical l.p. Earth-Return System.

It should be realised that shoe fuses offer little protection to the equipment. Each shoe fuse must be capable of feeding all the motors connected to it without the assistance of other shoe fuses in parallel. This means, in the case of a heavy multiple-unit train provided with a bus line, that each fuse must carry the accelerating current for possibly eight 280-h.p. motors, or, at 600 V, about 3,600 A. Normally, however, the average number of shoe fuses in parallel feeding such a train would be four, thus over 10,000 A could be carried by these fuses, and they would not blow until a loading of about 20,000 A had been reached. It is obvious that such an arrangement offers little, if any, protection to the equipment, but it must not be forgotten that shoe fuses do offer a limited protection, and at the right point, *i.e.*, the source of energy to the train, and some protection is therefore afforded for the cabling in the car. Shoe fuses also offer protection against "shorts" formed by broken shoes when passing over complicated crossovers. They should always be mounted on the under frame adjacent to the shoe beam, and not on the shoe beam itself, where the vibration is excessive. It has been suggested that the shoes should be capable of being lifted from the live rail by remote control means, and that, due to the amount of iron present, the arc created might

automatically blow itself out. This idea appears a little bit unpractical, but if something on these lines could be developed which could be operated by relays on overload, the protection to the equipment could be provided at the point where it is required. The conditions governing train line fuses are very similar, but not so bad. Two may always be in parallel feeding into a fault, and each one must be capable of carrying at least a whole set of equipment. The writer does not consider, therefore, that train line fuses offer sound protection.

In the opinion of the writer, shoe fuses could easily be eliminated; one very large electric railway system in this country is operating without them. Where train line bus-bars are used, train line fuses are advisable. They should be mounted on the under frame so that they protect the maximum possible amount of cable. Furthermore, with the fuses so mounted there is less chance of trouble if they do not clear quickly. Common protection for both main and auxiliary circuits is not desirable. If, however, the power circuits are provided with some efficient form of overload device, such as line switches and overload relays, and the auxiliary circuits are each provided with an efficient type of cartridge fuse, it is permissible to cover both these items by one common protective device. This arrangement has been carried out on 1,500-V installations in which an elaborate h.p. fuse on the roof acts as the main protection for both the auxiliary circuits and main circuits.

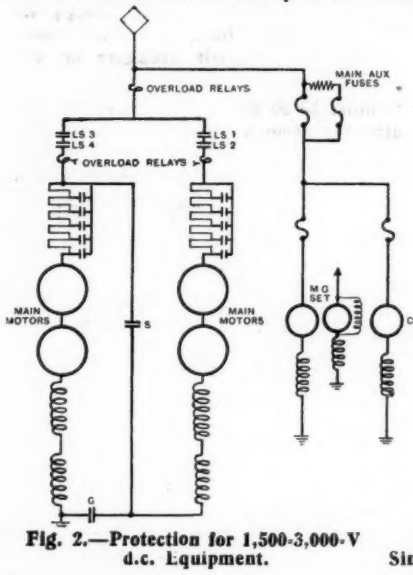


Fig. 2.—Protection for 1,500-3,000-V d.c. Equipment.

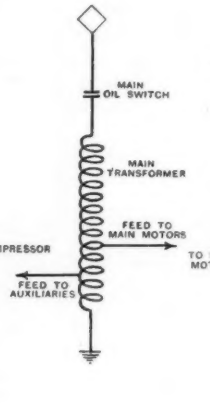


Fig. 3.—System for Single-phase, 6,000-15,000-V.

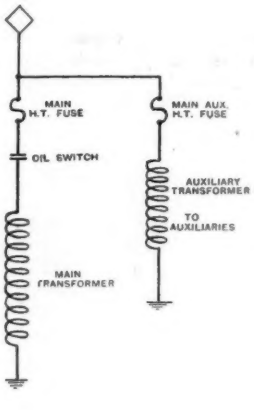


Fig. 4.—Method for h.p. Single-phase System.

This arrangement is only permissible on rolling stock where a battery is provided floating across the motor generator, so that a l.p. supply for lighting is always available. In the vast majority of cases, however, it is desirable that the power and auxiliary circuits should both have their own main protection.

It follows that where these various auxiliary circuits are fed directly from the source of supply, and not from the l.p. side of a motor generator, it is impossible to arrange that each of these are protected by means of fuses or circuit breakers fully capable of clearing any short circuit that may come upon them. Arrangements should be made so that should one of the auxiliary-circuit fuses fail to clear, arcing would not continue, but the fault would be thrown back on to the main auxiliary fuse or circuit breaker.

On l.p. systems the conditions are such that if fuses or circuit breakers fail to clear, arcing of a very serious nature may be maintained without bringing out the feeder or sub-station breakers. It is therefore necessary to ensure that the circuit breakers or fuses can deal with any load that is likely to come upon them, and further, that all the circuits should have two points of protection. The author recommends the use of circuit breakers or the equivalent mounted in the apparatus compartment, or under the coach, and, in addition, adequate main power fuses mounted under the coach, so that these fuses offer protection to all cables before entering the driver's cab or apparatus compartment. The auxiliary circuits should be protected individually by efficient cartridge fuses fed from main auxiliary fuses of high rupturing capacity mounted under the car.

If overhead conductors are used on l.p. systems there are certain advantages in having the main power and auxiliary fuses mounted on the roof. It is most desirable that all cables and apparatus within the cab or apparatus compartment should be protected by fuses externally, as the danger of arcing is infinitely greater in a confined space.

The principle, on other than low voltages, of designing the main circuit breaker or fuse of a locomotive to clear any fault which may come upon it is absurd. An electric locomotive will last for many years, and after ten or twenty years it may still be doing useful work, yet the short-circuit characteristics of the sections which it runs over may be entirely different.

The higher the voltage used, the easier it becomes to transfer a fault from one point to another of higher capacity more adjacent to the line.

High-speed circuit breakers or oil switches used on locomotives for high voltages, d.c. or a.c., may easily be provided with additional devices to prevent them opening at all on currents above a certain value, or they may be arranged to have a delayed opening on heavy currents. Either of these methods will mean that a fault on the locomotive which is beyond the capabilities of the protection is transferred to the feeder breakers. It will, therefore, be safe for such a locomotive to operate on any system, even though the short-circuit characteristic of that system is infinitely greater than when the locomotive was originally designed. Above 1,500 volts the use of fuses for the main power circuits has not been found successful, and the majority of locomotives are provided with overloads operating on the line switches. The writer strongly recommends the use of a high-speed circuit breaker, or a very efficient type of circuit breaker fitted with a lock-out relay, so that it cannot open beyond its breaking capacity, and ordinary overload relays operating on the contactors.

The auxiliaries can utilise the main circuit breaker as main protection, but the better arrangement is to provide a small circuit breaker and connect in the circuit immediately on the ground side of this breaker a small protective resistance. A very small resistance will limit the current to a value that this auxiliary circuit breaker can easily deal with. Although fuses have been used successfully on 6,600-V single-phase systems, the writer is not in favour of their use.

On many single-phase locomotives the tappings from one transformer supply both the power circuits and the auxiliary circuits. In such cases a battery should always be provided for lighting, and it is permissible that one oil switch of suitable capacity be used for the protection of the primary h.p. circuits. Even if two transformers be used, one for the main power and one for auxiliary, it is permissible to utilise one oil switch for the h.p. circuits, providing a battery is available for lighting. In addition to this, such locomotives or motor coaches could be provided with a simple overload device

on the l.p. circuits of the motors, so that the oil switch is not tripped out on the h.p. side for any relatively small fault on the motor circuits, or for ordinary overloads.

The protection of the individual circuits on the l.p. side presents no difficulties, as the voltages are low, and a good grade of cartridge fuse is in every way satisfactory. It is impossible, of course, to mount the circuit breakers and oil switches of high-voltage systems, a.c. or d.c., on the roof or the under frame in the vast majority of cases. They could, however, easily be contained in well-made steel cubicles, and should they at any time fail to clear, the arc will rapidly transfer to the earthed steel cubicle and the feeder breakers will ultimately clear the fault.

The cables leading up to the circuit breaker should, of course, be enclosed in the heaviest gauge pipework, and the steelwork of the cubicle must be sufficiently strong to allow a certain amount of arcing without burning through.

As practically all protection on the auxiliary circuits is afforded by fuses, these must be so arranged that should a local-circuit fuse fail to clear, the conditions would rapidly become worse, and the short-circuit current so increased that it would become sufficient to blow the fuses of higher capacity more adjacent to the line. On earth-return systems utilising single-pole fuses this is easily provided by having the fuses in suitable ironclad cases, which, of course, are efficiently earthed. Should the fuse fail to clear before any burning can take place outside the earthed casing, the short-circuit current must necessarily be increased and the fault transferred to fuses of higher capacity. In the case of non-earth-return systems, of which a very large number are in existence, the utilisation of ironclad gear will not necessarily cause transference of the protection to higher capacity fuses. The writer recommends for such a system that ironclad apparatus be used, but that the fuses are always mounted together in pairs, *i.e.*, the positive and negative fuses of a given circuit mounted adjacent to one another. They should be sufficiently far apart within the case to prevent a slight burst of one fuse from creating a "short," but near enough to allow a short-circuit to be created before burning through the case can take place.

Main and main-auxiliary fuses on l.p. equipment must, of course, not be ironclad, as their duty is to have as high a rupturing capacity as possible, and not to transfer faults to higher-capacity protective devices more adjacent to the supply.

It is common practice on low-pressure systems and others to carry an earthing bar which can be placed across two live rails, or, on an earth-return system, between the live rail and earth. If these bars are reasonably carefully handled they can be used with complete safety. It is necessary, however, for the driver to bring the train to a standstill and to get out before the short-circuiting of the conductors can take place. Systems have been introduced recently whereby a short-circuiting device is provided in the locomotive itself; this is considered to be extremely useful on the higher-voltage systems, where a short circuit will cause the feeder sub-station circuit breakers to open. On the lower voltages the device may not be so useful, but the system as a whole is one well worthy of consideration.

Conclusions.

(1) The arrangement of protection should be such that the main power circuits and the auxiliary power circuits are kept as separate from one another as possible.

(2) Apart from ordinary overload relays and auxiliary-circuit fuses, additional protection should be afforded to both circuits in the form of some type of protective apparatus close to the supply of energy to the coach. This may take the form of special fuses, circuit breakers, high-speed circuit breakers or oil switches.

(3) The circuits must be so arranged that either the protective apparatus can never have a greater fault current to break than it is capable of, or be arranged so that should it fail to break the fault current on it, the breaking of such current will be transferred to protective apparatus more adjacent to the supply without undue damage to the equipment or danger to the *personnel*.

(4) It should be realised on low-voltage systems that it is very difficult to throw faults back on to the feeder or sub-station breakers, and that therefore the protection of low-voltage systems is more difficult than that of high-voltage ones.

Pressure Out-of-Balance.

A Practical Instance of Unbalance on a Three-phase and Single-phase Power and Lighting System.

By VERNON W. PALEN.

RECENTLY the complaint bureau of a large electricity supply company reported what seems to me a very interesting case of unbalanced voltage. Investigation of the situation showed that the complainant was receiving three-phase power from one bank of transformers and light from a separate lighting transformer.

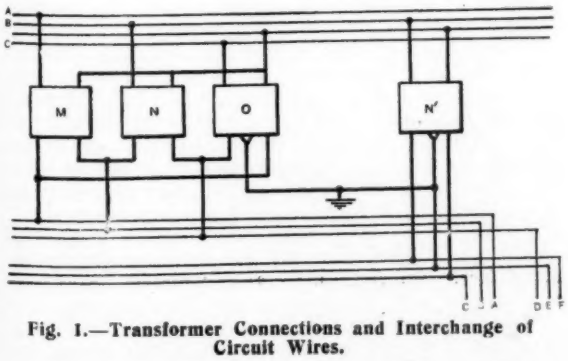


Fig. 1.—Transformer Connections and Interchange of Circuit Wires.

In accordance with standard American practice the mid-point of the secondary of the lighting transformer was earthed, as well as the mid-point of one of the power transformers, and hence the phase winding. After a thorough check-up, the transformer installation was found satisfactory. The three power wires along

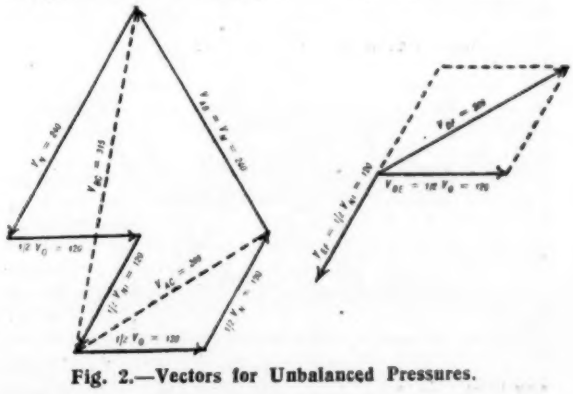


Fig. 2.—Vectors for Unbalanced Pressures.

with the three lighting wires all left the transformer room by way of one conduit, and where they emerged at the other end it was found that one power wire had been interchanged with one lighting wire as in fig. 1.

The vector diagrams showing the voltages resulting from this condition are shown in fig. 2. Since transformer N and transformer N¹ are on the same phase their voltage vectors will be parallel. v_{AB} v_{BC} and v_{AC} represent the voltages supplied to the motor terminals by this incorrect connection, while v_{EF}, v_{DE} and v_{DF} are the voltages on the lighting circuit.

It will be seen that the 120-volt lighting circuits were unaffected. Only across the two outside legs of the lighting circuit was the voltage below normal, it being 209 instead of the expected 240. This fact provided the first clue to the trouble.

The complainant's attention was first drawn to the case by the persistent blowing of the fuses on one phase of the power circuit.

Overhead-Line Insulators.

The author stresses the importance of obtaining records of insulator performances for the conditions peculiar to this country, and suggests that the Overhead Lines Association should undertake the task of collecting and compiling the necessary information.

By R. C. ANDERSEN, M.C., A.M.I.E.E.

CONTINUOUS records of line insulator performance are fundamental to intelligent progress for the following reasons:—By indicating incipient deterioration they safeguard continuity of supply; they form a basis for research; from them is derived the best average insulator design for a given set of operating conditions; and they constitute a very potent weapon in the hands of competent salesmen.

But effectively to record insulator performance is by no means a simple matter; observations under varying and totally different conditions are required. These comprise fog, smoke, salt spray and lightning—to name only a few. Each requires separate study, for under each there is a wide variation in efficiency for a given insulator design. Thus, for example, a good "fog" insulator generally gives poor service in a lightning district, and it follows that only by a conscientious application of trial and error, over a prolonged period, can the most suitable insulator for a system be chosen.

In the United States of America the compilation of line-insulator statistics has become a science, and this fact has had an important bearing on the history of American electrical power development. Instituted as a safeguard against the repeated line failure suffered by the pioneers of high-voltage transmission, their line records, besides helping the Americans to eliminate various weaknesses in their manufacturing processes, have provided them with most valuable sales propaganda which they have not been slow to use in foreign markets. As an insulator with a background of operating data sells more readily than one without, their success in these markets has been considerable. The part played by America's technical associations in this development deserves recognition. By deliberately co-ordinating the records of individual power companies, and fostering further studies in the field, they have rendered a national service to their members. Its value is manifest in the astonishing rate at which successful line construction has been completed in the States. To-day the American light and power industry ranks amongst the most important in that country.

That British supply engineers should have found it unnecessary to give similar attention to line statistics speaks well for the efficiency of the insulators installed on their systems; but with the advance of knowledge on the subject it is becoming clear to observers intimately connected with electricity supply that a reaction against an attitude of *laissez faire* is rapidly crystallising. Indeed a very definite English school of thought relating to insulator design has come into being within the last two or three years. It deserves proper direction.

Progress must have a basis from which to measure advance. In 1920 the B.E.S.A. Committee published the first British Standard Specification pertaining to line insulators. This document, which is now undergoing revision, was of incalculable value in affording a focus for insulator experience. Engineers have not hesitated severely to criticise many of its clauses; but—and this is the important point—the fact that the specification gave them something tangible to shoot at has naturally resulted in the creation of a mass of co-ordinated opinion of great value. When the demands of our supply engineers are met by the new specification (as it is assumed they will be), a big advance will have been registered in British insulator practice.

Though the industry is to be congratulated on the progress indicated, I hold that much of its value will be lost unless steps are immediately taken to organise a nation-wide movement for a scientific compilation of line-insulator statistics. Technically, this will eliminate loose, individual opinions about which are the best insulator designs to adopt, and it will replace these opinions by definite findings on the subject. Commercially, the knowledge derived will prove of immense assistance to British insulator manufacturers, not only in so far as their research work is concerned, but also as sales propaganda when it comes to competing for colonial and foreign business.

On this score, mention has been made of American methods. In the domain of research—however keen the student—he will be the first to admit that the only sure basis for his work is that created by direct and prolonged analysis of insulator performance in the field.

If the views expressed find any acceptance, the question arises as to the best means to adopt to obtain national statistical data. I can think of no better organisation to suggest these means than the Overhead Lines Association. Inaugurated spontaneously in answer to an astonishing demand for co-operation by supply engineers, this young body has already a great deal of constructive work to its credit. The task now suggested is admittedly an onerous one; but the results would be of immense value to British electricity supply.

On the other side are ranged the electricity supply authorities and companies. It is on the shoulders of their engineers that the main burden will fall. But on the other hand they would derive much benefit from their work. Will they undertake the tedious detail involved? My experience of their methods leads me to assume that they would enter wholeheartedly into a movement such as is indicated. British insulator problems are specific. The statistical evidence suggested should have for its aim definite conclusions as to the best insulator designs to adopt for frozen fog, salt spray, polluted industrial atmospheres, and, to a lesser extent, for lightning.

Much bibliographical matter exists for insulator performance in foreign countries, but this only has an indirect bearing on English problems, which, taken as a whole, are somewhat unique. Now that Britain is entering into the sphere of co-ordinated electrification on a large scale, a great opportunity will be lost if statistical records on a national scale are not inaugurated.

Agricultural Electrical Machinery.

A review of the exhibits at the 1928 Paris Agricultural Exhibition, depicting some items of special interest to electrical engineers.

By R. BORLASE MATTHEWS, Wh.Ex., M.I.E.E., A.M.Inst.C.E., F.R.Ae.S.

(*Concluded from page* 364.)

IN the previous section of these notes reference was made to the increased employment of small high-speed motors. One maker of electric motors—Dassenoy—is now introducing machines of from one to ten horse-power of the squirrel-cage, three-phase type, running at 3,000 r.p.m. When the rotor is at rest, it is kept out of the centre of the magnetic field by means of a spring, which slides it along the shaft. Hence, on starting up, the heavy demand upon the central-station mains that is characteristic of the ordinary squirrel-cage motor is avoided. Further, since the rotor gradually slides into its working position as the magnetic field builds up, it serves as its own starter. Of course, the first cost is considerably reduced as compared with that of a motor running at half the speed.

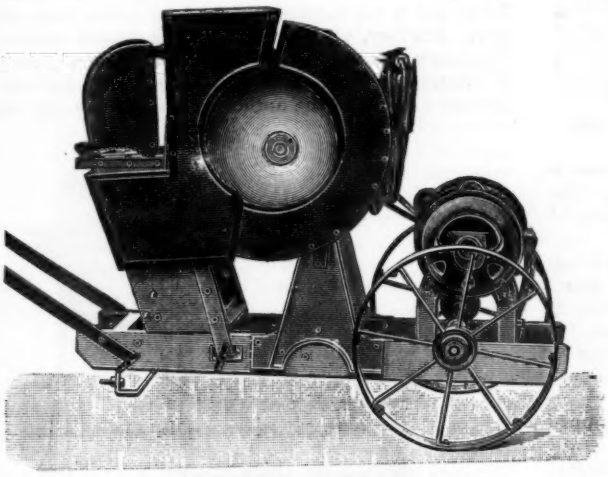


Fig. 7.—"Circular-Saw" Farm Motor Set.

A portable farm motor of L'Agro make, fig. 7, has the disadvantage that in use it is supported on wheels, but it has several novel and useful features that possibly more than counteract this. The countershaft consists of a standard ball-bearing "circular-saw" fitting held in position on the vertical support by means of two U bolts. The writer has often thought that these "saw-spindle" sets could be advantageously used for countershaft purposes, but this is the first case in which he has seen the idea carried into practice. The motor starter is fitted in between the uprights that support the countershaft, while a convenient saddle is provided immediately behind for the flexible cable.

Apparently it is now considered that there is practically no other way of pumping water than by the aid of an electric motor, if one is to judge by the display at the exhibition. High-pressure water-delivery systems have become very popular. Though there are many designs, a great many employ the same make of automatic control—the E.M.A. It is, of course, a very great time saver on a farm to have the water available from the tap at a pressure of forty pounds or so per sq. inch. The motors employed for this work are all of the fractional horse-power type, since, owing to the storage cylinder, only a small amount of power is required, which is spread over a long period of the day. Several very neat worm-drive reduction-gear, crank-operated pumps were exhibited. In this design the motor is mounted on and forms a part of the head of the pump (see fig. 8). The worm-wheel runs in an oil-bath, and hand operation is also provided for.

A distinct novelty that was seen was an electric pump designed for lowering into wells. The actual pump is located inside the rotor of the h.p., a.c. motor. Very few liquid-manure pumps were on view.

More cream-separating machines were on view this year with their driving motors incorporated in the structure of the machines. In nearly all cases the belts were protected by metal casings. To illustrate how easy it was to operate a de Laval separator, one was shown at work driven merely by the draught of air from an electric fan impinging upon propeller blades affixed to the machine.

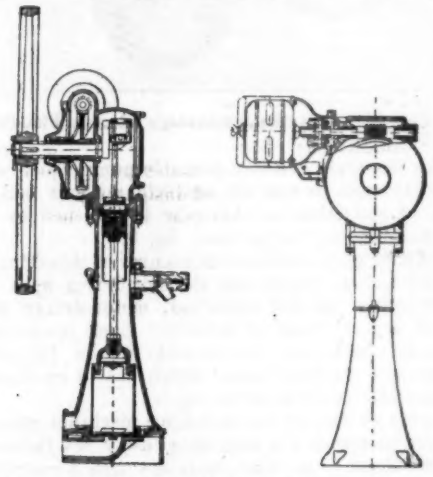


Fig. 8.—Worm-drive Crank-operated Motor Pump.

Pumps for milking machines exhibited were all operated electrically. A new feature was that every maker also showed portable electric pumps. This type would be especially useful to the tenant farmer, as it is so much easier to convey electric wires about a building than to erect permanent vacuum piping, or overhead actuating rods. An entirely new type of milking machine has just been brought out by the makers of the Melotte cream separator; it requires an electric motor of from 1½- to 2½-h.p. to drive it. The pulsator for regulating the alternations in the suction on the teats of the cow is fitted on the vacuum pump, with additional pulsators on every thirty yards of pipe line. This latter feature is a very good idea, as regularity and effectiveness of pulsation are of very great importance in artificial milking. By the ingenious design of the multi-way connector for the four teat cups, any of the latter, when hanging preparatory to placing on the

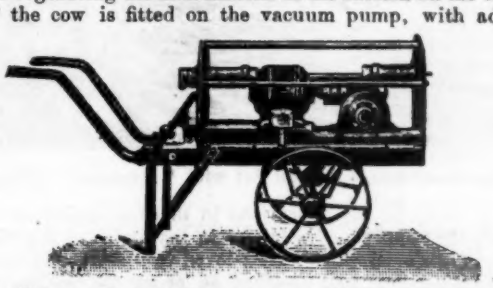


Fig. 9.—Portable Vacuum-pump Milking Machine.

cow, form a self-closing valve, as the rubber tube bends over the orifice of the metal fitting.

Improvements in connection with the Alpha-Laval milking machines were chiefly confined to portable motor-driven vacuum pumps. This was also the case with the Hinman-Amanco milker. One of the portable pumps for the latter is truly portable, as it is operated by a very small motor and is easily carried by hand.

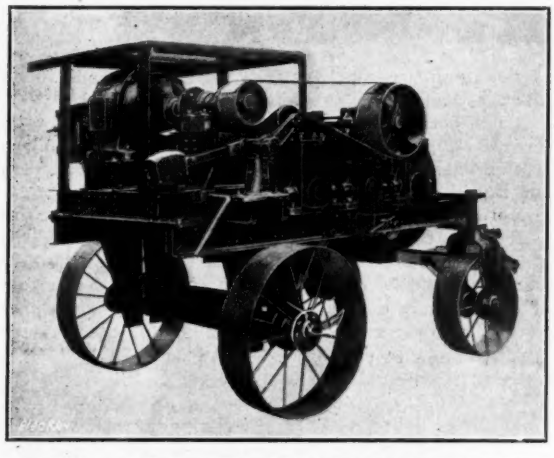


Fig. 10.—A Stationary-haulage Electric Ploughing Set.

The Beauvais & Robin portable pump which was seen is constructed to operate entirely without belting. The speed reduction in this case is obtained by means of a ball-bearing worm wheel, fig. 9.

Although a considerable number of threshing machines were shown, nearly all the belt-drives were too short. Evidently the self-contained, motor-driven thresher is still a new thing in France. Such machines are far more useful and convenient to the farmer than a separate portable motor which has to be lined up each time the machine is moved.

One or two of the threshing machines were equipped with elevators for conveying away the threshed straw. One outfit was also equipped with a conveyor-feeder, which was mounted on a form of turret on top of the thresher. One exhibitor specialises in parts whereby a farmer can construct his own conveyors. It is increasingly becoming the custom to install transporters that will hoist and traverse to a convenient position in a barn a complete cartload at a time of hay or corn.

No less than five electricity supply undertakings in France are about to commence contract ploughing for farmers in their areas. They have all been watching

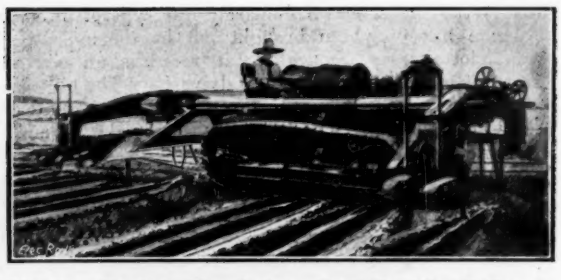


Fig. 11.—Haulage Plough Set with "Mounting" Ramps.

very carefully the operations in this connection of the company supplying electricity in the plains of the Oise, North of Paris, which have proved very successful. One exhibiting firm had received an order for ten electric ploughing sets from one undertaking alone. Owing to their bulk, full-size machines were not on view. An exception, however, was the "Pan," fig. 10, which is a new-comer into the field. This is a stationary-haulage set operating on the round-about system. Continental electric plough manufacturers have slavishly copied the orthodox British steam systems developed during the past fifty years; in fact, many of the parts used in their machines are made in England. A double-rope haulage set of a radically new design—the Giesberger—which was exhibited at the Paris show, should give all designers much food for thought. In this new ploughing set, in place of a balance plough, two steel frames carry the plough shares. These frames are connected together by a strong tubular member some 12 ft. in length (see fig. 11). Ramps or inclined runways are provided upon each haulage set, and when the plough reaches the end of its journey it mounts up on the haulage set, right out of and off the ground. It is then ready for transfer into position for the next set of furrows. This means that the headlands are reduced to a minimum, as the furrows end at the line of progress of the haulage set, which incidentally results in much neater ploughing. Since the plough is always mounted upon one of the haulage sets, it greatly facilitates manœuvring. Double sets of haulage ropes, spaced 12 ft. apart, are employed, which ensure parallel ploughing.

A novel process of dealing with hay for town use has lately been developed in France. The hay is placed on revolving prongs which rapidly convert it into a cylindrical bundle. These bundles are compact and yet retain the long stalks of the grasses, which are a better aid to the digestion of food for horses than chaffed hay. Further, all labour in cutting trusses is avoided. Obviously this new type of machine especially lends itself to electric driving. The Société Générale Agricole exhibited a model of the author's method of curing hay.

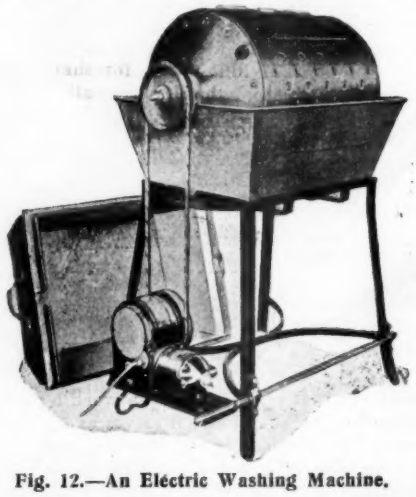


Fig. 12.—An Electric Washing Machine.

Quite a number of winnowing and seed-cleaning machines were shown electrically driven, and the Law portable electric motor, with its self-contained reduction gear, seemed to be the favourite driving unit. The Marot machines, in particular, had a very neat bevel gear drive to which the electric motor was connected. These and several other makers' machines were using wood rollers running on the screens to clear away any seeds that had jammed in the apertures—a much more effective method than the use of brushes.

Included in the oil-engine exhibits was the Andreau engine, shown in section and rotated by an electric motor. The peculiarity of this engine is that the working length of the connecting rod is slightly altered during operation, due to the control of a link attached to a subsidiary gear. This varies the length of the stroke of the piston, which is short for admission and compression, but twice the length for firing and exhausting.

The farmer's wife does not seem to get overlooked by any means at a French agricultural show, for literally dozens of makes of electric washing machines were on view, nearly all of very much cheaper construction than, though not of nearly such good workmanship as, the British and American washers sold in England. The general type favoured has an all-metal drum to contain the clothes, which rotates several times in one direction and then reverses. A cover which exposes nearly half the washing drum is placed over the machine while it is in operation. Fig. 12 shows one type of electric drive.

Amalgamations in the Electrical Industry.

A Consideration of Electrical Combines, Associations and Financial Trusts.

By A. W. WILLSMORE.

A MUCH discussed phenomenon of economic activity during post-war years has been the growing tendency towards amalgamations in industry. The attention of the engineering industry was focused on the new development by the recent fusion of the Armstrong, Whitworth and Vickers concerns. In the electrical branch there has been a recrudescence of interest with the rumours of mergers in the heavy electrical engineering trade. Curiosity has also been aroused by the activities of the Greater London and Counties Trust which has recently acquired holdings in a number of large electrical supply undertakings in Southern England, and the moment seems opportune for a consideration of the advantages and disadvantages of the movement.

Amalgamations in industry have been of very widely different types. Perhaps the commonest form is the combine. This is an amalgamation of several businesses aiming at a complete mergence, under one management, of the various merging companies to exchange their holdings in the individual firms for shares in a main holding company, which thus controls all the individual concerns. Of course, amalgamation is not always so thorough as in this case, and the movement often exemplifies itself in one large company buying a number of smaller competitive firms, or in two large manufacturing firms merging their interests to form a larger, stronger and more sound economic concern.

The usual form of amalgamation is that between companies in the same industry, and is referred to as a horizontal combination. But one not infrequently meets cases of vertical combination where companies engaged in successive stages of manufacture are combined to form a complete chain from raw material to finished goods all under the same management. The order of the day, however, is for horizontal combinations. When several concerns unite to form one large undertaking, there naturally results a much more efficient control of production than was possible in the small units, and a much better balance is established between production and consumption. Of course, the basic idea behind the movement is the formation of a complete or partial monopoly, but the movement is not to be condemned on this ground alone. Unrestricted competition can prove infinitely more detrimental to the interests of the consumer than can a semi-monopolistic concern. The situation to-day gives little support to the notion that the great industrial combination acts contrary to public interests by putting up prices. Indeed, the economies resulting from mass production, and the saving effected by the creation of common research, sales and propaganda departments, often allow of quite a substantial reduction in price to the consumer, while giving a fair margin of profit to the new combine. Moreover, the movement tends to prevent over-production with its attendant booms and disastrous slumps. There are admittedly certain inherent dangers in the system, but when properly managed, the development is sound from the points of view of both the consumer and the producer.

Combines are usually the outcome of keen competition forcing down prices to an unprofitable level. For instance, in the heavy electrical industry, we have acquired the leading position in foreign world trade. Profits, however, are on an extremely low level because of the keen competition to secure business in a market which is not capable of absorbing full manufacturing capacity. Admittedly, it is unfair for the prosperity of an industry to be marred simply because production is, say, 15 per cent. in excess of demand, and it is suggested that a merger between the principal companies in the industry would remedy this state of affairs.

The idea of complete amalgamation, however, does not appear to have appealed very strongly to manufacturers in the electrical industry in this country, where a more loosely knit combination with a comparatively limited object in view, seems to have been favoured. These combinations have taken the form of Trade Associations, in which several firms of a similar nature get together with the object of eliminating excessive competition by limiting output, fixing minimum prices, or apportioning out the market among the members of the association. British manufacturers have been more or less forced to form some such amalgamation as a result of the activities of similar undertakings on the Continent, and it is difficult to find any real objection to the movement. The associations do not seem to have shown any desire to maintain prices at an unfair level; indeed, it is very doubtful whether it would be possible for them to do so, and they certainly have served a very useful purpose in maintaining the quality of the products manufactured by the various associate members. In a price-cutting war, quality must suffer, and the reputation of the industry has been built up on a quality basis. The most serious objection seems to be that it is likely to lead to inefficient firms being nursed at the expense of the stronger members of the industry.

Finally, there is another form of amalgamation—the power finance corporation—which does not seem to have found any great favour in this country, although the field of its activities on the Continent and in Europe is enormous. The aim of such finance trusts is obvious, and really amounts to lending the purchaser the money to buy from you. The Greater London and Counties Trust has recently acquired holdings in several electricity undertakings in Southern England The Trust has considerable American backing, and it has been suggested in certain circles, that the development is likely to lead to British electrical business going to America. As a matter of fact, the Greater London and Counties Trust is not so much a power finance corporation as an ordinary investment trust, and holds shares in the North Metropolitan Electric Supply, Edmundson's Electricity Corporation, the Oxford Electric Company, Western Electric Distributing Company, East Anglian Electricity, Wessex Electricity Company, and the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Company. With one exception, all these undertakings are primarily engaged in the distribution rather than the production of electricity, and the main object of the trust is to develop sources of demand for electricity, and to link up areas large enough to justify scientifically co-ordinated distribution schemes. The control of the undertaking remains in British hands, and it may serve a useful purpose in developing electricity in rural areas.

On the whole, therefore, the amalgamation movement in the electrical industry seems to have so far manifested itself in the formation of price-fixing associations and rings. Although there are signs of closer combination among the manufacturing companies and of power finance developments among the supply undertakings, the state of affairs seems quite sound and certainly does not justify any alarmist rumours of exploitation of the public on the manufacturing side, or of American control on the supply side.

Argentina as an Electrical Market.

An Extensive Building Programme calls for Large Supplies of Wiring Material.

By PERCY F. MARTIN, F.R.G.S.

At no period in the economic history of Argentina, uniformly progressive as it has proved, has opportunity for the practical electrical engineer and the enterprising manufacturer of all kinds of electrical apparatus been greater or more attractive than to-day. The Argentine market has become the electrical manufacturer's Mecca. The main reason for this is the remarkable development of industrial establishments with electrically-driven power, and the house-building programme, the largest yet adopted—two factors in the situation which will call for the installation of electrical appliances upon a scale never before experienced. The erection of some thousands of up-to-date dwellings, however, is quite independent of many other great schemes which embrace the electrifying of several additional railway lines, public lighting projects in a number of important commercial towns, the installation of electrically-operated port equipment, and more than one costly transport scheme. In Argentina to-day the use of electricity in cities, towns, and even hamlets in one form or another is no longer the exception but the habit.

In this attractive field of enterprise there are to be found, as a matter of course, many keen and active competitors. All the chief manufacturing countries of the world are represented, and their salesmen are scrambling for the remunerative trade of Argentina. Great Britain, in the face of the most intense price-cutting rivalry, still holds a prominent place for supplies of electric wire and cables (although the United States and Germany have actually displaced us from our one-time practically monopolistic position); America stands first in the matter of batteries and numerous other electrical supplies; Holland in lamps; and Italy for certain types of generators and motors. If quality always gained the upper hand, the British manufacturer would have less reason to fear his principal rivals.

During a normal year, between 8,000 and 9,000 tons of wire and cables of all classes are imported into Argentina. In 1928, in view of the many large construction contracts entered into for early completion, it is believed that the quantity of such materials will approach, if not exceed, 10,000 tons. But British contributions will not be much larger unless greater activity is shown among manufacturers' local agents in South America. The United States is now offering goods at cut prices, and conceding favourable payment facilities for material coming within the three main categories:—(*a*) Transmission cables for public works, which are allowed to enter Argentina free of duty; (*b*) insulated wire and cable of 5 mm. diameter or more, which pay 7 per cent; and (*c*) insulated wire and flexible cord, of a diameter less than 5 mm., which pay 32 per cent. duty.

To deal in a single article with all, or even the greater part, of the diverse classes of electrical manufactures imported into Argentina nowadays, would be obviously impossible. The writer proposes, therefore, to outline the market openings that occur, or are likely to offer, in Argentina for wiring devices used for houses, together with a summary of the municipal regulations governing their installation.

Apart from the additional 70,000 dwelling-houses about to be erected in Buenos Aires, which will call for wiring from top to bottom, a number of new buildings are to be put up by the Municipality, which will include a house for the Faculty of Engineering, to be erected upon a site between the Callé San Martín and the Avenída Maipú. While wiring will not, however, be undertaken for at least a twelvemonth hence, the contract will be placed before the coming spring. Also, there will be built during this year no fewer than 800 villas or houses, some of a very pretentious character, calling for the installation of complete electrical equipment, from the lighting of the various apartments to the working of passenger and service lifts, kitchen stoves, and private laundries. Other, and perhaps the great majority, of the new constructions will be for the occupation of middle- and working-class tenants; all alike, however, will be wired for electric lighting, and some, additionally, for electric cooking. Radio apparatus will be installed, to be operated from the mains, in a few cases.

The population of Buenos Aires is now officially declared to be close upon 2,000,000, a large proportion of the total population of the Republic (about 10,000,000). But besides Buenos Aires, there are several large and growing cities—Rosario, Bahía Blanca, Mendoza, Córdoba, Tucumán, &c.—where house-building is proceeding apace, calling for more and more electric lighting and power installations of almost all types. In the Federal capital, also, there has been awarded recently, after competition, an acceptable municipal contract for the installation of the electrical equipment of an abattoir, to cost 7,365,000 pesos paper (say about £618,000). This has now gone to two American companies and one native firm, working in combination, and work upon the contract has already been commenced.

At the end of 1926 the total number of houses was put at 1,200,000. There were 450,000 dwellings wired for lighting, while the number of commercial and other consumers was 130,000. With the exception of Uruguay, Argentina leads electrically among the twenty Latin-American countries.

Until recently there have been no rules in force governing the wiring of houses or other buildings. The result of this official negligence was that a very low grade of wire was commonly employed, such products coming in large quantities from the United States and Germany. British houses, for the greater part, have shown themselves unwilling to turn out, under their trade marks, wire of inferior quality Nevertheless, a market will always be found for this cheap material in preference to that of a better grade in localities where it can be used without infringing official regulations. But to-day, when a great deal more wealth exists in Argentina and people can afford to spend more upon the equipment of their dwelling-houses, contractors are urging upon architects and their clients the use of better-grade material. More than this, the matter of cheap wiring in houses or other edifices, casting as it must a reflection upon the advantages to be derived from efficient electrical engineering, has been taken up actively by the Asociación Electrotecnicos del Argentina, which body has issued, and distributed widely among builders and domestic hardware dealers, copies of its rules and regulations. The circulation of these brochures has secured, to a very considerable extent, the adoption by municipal authorities and their architects of more stringent conditions governing electrical installations. For instance, the municipal authorities of Buenos Aires now adopt a set of regulations, among which the following may be quoted:—

(1) Wires shall be insulated, and the insulation must show at least 500 megohms per kilometre after immersion in water at a temperature of 15 deg. C. for 24 hours; (2) the current must be such as will not raise the temperature of the conductors above 40 deg. C.; (3) for conductors of copper of high conductivity the maximum current density is 4 amperes per sq. mm. for currents less than 25 amperes; above this limit there is a graded scale going up to 430 A for 310 sq. mm.

Conductors of copper having a cross-section less than 0.75 sq. mm. or with a diameter of, say, 1 mm., are not recommended for use.

Large quantities of twisted cord are used in Argentina. German electric wire manufacturers use a very cheap kind of covering, but their product as a saleable article does not suffer in consequence. Latterly, German manufactures have had to compete with Italian and Japanese products of the same class. Yokohama and Tokio factories are now supplying the Argentine market with an extra flexible cord of a remarkably cheap and fairly good quality. There is a good market for electrical wire for special purposes. Annunciator and other cotton-covered wires are being turned out by factories established in Argentina itself, the makers buying abroad the bare copper and the cotton and making them up on machinery also purchased in Europe or the United States, or even constructed locally. At least one Argentine firm is able to draw the wire to any desired size in its own shops.

British manufacturers enjoy a high reputation in Argentina, as, indeed, throughout South America. A well-known British company's wiring system is to be found installed in a number of buildings, its neatness, inexpensiveness, and other advantages appealing to experienced architects. A surface system has been used for a number of installations; but, while this is recommended chiefly on the score of inexpensiveness, the best installations for new houses usually consist of v.i.r. wires drawn into screwed steel tubing.

The Electrical Imports of Argentina.

Figures for 1925 and 1926 compared.

THE Argentine Government has recently issued detailed statistics of the country's foreign trade in 1926. The following table shows the values of the various descriptions of electrical materials imported in that year and in 1925, together with a note of increases or decreases. The values are the Argentine Customs Tariff valuations; the gold peso equals about 4s.

	Gold Pesos. 1925.	Gold Pesos. 1926.	Gold Pesos. Inc. or dec.
Clamps or porcelain tubes—			
Total *	16,000	17,000	+ 1,000
Pushes and electric bells—			
Total *	25,000	14,000	− 11,000
Electric bells—			
Total *	66,000	57,000	− 9,000
Carbons for arc lamps—			
Total *	9,000	10,000	+ 1,000
Electric meters—			
Total	784,000	916,000	+ 132,000
From Germany ...	407,000	494,000	+ 87,000
,, France	276,000	145,000	− 131,000
,, United Kingdom	54,000	149,000	+ 95,000
,, Belgium ...	16,000	119,000	+ 103,000
Small electric motors for fans, &c.—			
Total	128,000	235,000	+ 107,000
From Germany ...	30,000	76,000	+ 46,000
,, United States ...	68,000	114,000	+ 46,000
,, United Kingdom	14,000	29,000	+ 15,000
Electric batteries—			
Total	447,000	671,000	+ 224,000
From Germany ...	64,000	85,000	+ 21,000
,, United States ...	338,000	528,000	+ 190,000
,, United Kingdom	25,000	37,000	+ 12,000
Materials for cells or storage batteries—			
Total	381,000	544,000	+ 163,000
From Germany ...	94,000	50,000	− 44,000
,, United States ...	175 000	283,000	+ 108.000
,, United Kingdom	50,000	114,000	+ 64,000
Porous jars for batteries—			
Total	11,000	8,000	− 3,000
From United Kingdom	8,000	8,000	—
Glass jars for cells and storage batteries—			
Total	11,000	18,000	+ 7,000
Plugs—			
Total * ...	3,000	20,000	+ 17,000
Wall sockets—			
Total * ...	12,000	10,000	− 2,000
Circuit breaking devices, such as "wall fuse sockets"—			
Total	15,000	19,000	+ 4.000
From Germany ...	9,000	12,000	+ 3,000
,, United Kingdom	1,000	600	− 400
,, United States ...	3,000	6,000	+ 3,000
Insulating tubes—			
Total	562,000	613.000	+ 51.000
From Germany ...	325,000	331,000	+ 6,000
,, United States ...	70,000	131,000	+ 6.,000
,, United Kingdom	154,000	128,000	− 26,000
Lampholders—			
Total	215,000	187,000	− 28,000
From Germany ...	149,000	101,000	− 48.000
,, United States ...	28.000	20,000	− 8.000
,, United Kingdom	4,000	4.000	—
,, Italy	34.000	57.000	+ 23,000
Apparatus for radio-telephony—			
Total	465,000	661.000	+ 196,000
From United States ...	289,000	390.000	+ 101,000
,, France	38,000	21.000	− 17,000
,, Germany ...	16.000	17,000	+ 1,000
,, United Kingdom	46.000	73,000	+ 27,000
,, Netherlands ...	74,000	146,000	+ 72,000
Apparatus for radio-telegraphy—			
Total, all from Germany	7,000	1,000	− 6,000
Accessories for underground cables—			
Total	56,000	143,000	+ 87,000
From Germany ...	9.000	32,000	+ 23,000
,, United Kingdom	37,000	77,000	+ 40,000
Electrical accessories—			
Total	751,000	1,164.000	+ 413,000
From Germany ...	227.000	202,000	− 25,000
,, United States ...	288,000	136,000	− 152,000
,, United Kingdom	216,000	804,000	+ 588,000
Accumulators—			
Total	243,000	78,000	− 165,000
From United States ...	82,000	31,000	− 51,000
,, United Kingdom	152,000	41,000	− 111,000
Insulators of earthenware, faience, or porcelain—			
Total	110,000	243 000	+ 133,000
From United Kingdom	32,000	96,000	+ 64,000
,, Germany ...	72,000	113,000	+ 41,000
Glass insulators—			
Total	800	600	− 200
From France ...	500	500	—
Wires and cables—			
Total	5,561,000	7,271,000	+1,710,000
From Germany ...	1,683,000	2,781,000	+1,098 000
,, United Kingdom	2,547,000	2,923,000	+ 376,000
,, United States ...	540,000	525,000	− 15,000
Ammeters and voltmeters—			
Total	113,000	139,000	+ 26,000
From Germany ...	23.000	41,000	+ 18,000
,, United States ...	81,000	83,000	+ 2,000
,, United Kingdom	4,000	10,000	+ 6,000
Telephone apparatus—			
Total	168,000	274.000	+ 106,000
From Germany ...	26,000	30,000	+ 4,000
,, United States ...	21,000	19,000	− 2.000
,, United Kingdom	42,000	183,000	+ 141,000
Telephone material—			
Total	30,000	52.000	+ 22.000
From Germany ...	5,000	2,000	− 3,000
,, United States ...	15.000	13,000	− 2,000
,, United Kingdom	7,000	29,000	+ 22,000
Telegraph material—			
Total	71,000	79,000	+ 8,000
From Germany ...	7,000	26,000	+ 19.000
,, United Kingdom	59,000	47,000	− 12,000
,, United States ...	2,000	2,000	—
Switchboards—			
Total	26,000	96.000	+ 70,000
From Germany ...	4,000	11.000	+ 7.000
,, United States ...	3,000	4.000	+ 1,000
,, United Kingdom	15,000	79,000	+ 64,000

* Mainly from Germany.

	Gold Pesos. 1925.	Gold Pesos. 1926.	Gold Pesos. Inc. or dec.
Switches—			
Total	148,000	187,000	+ 39,000
From Germany ...	97,000	82,000	− 15,000
,, United Kingdom	8,000	21,000	+ 13,000
,, United States ...	30,000	30,000	—
Electric fans—			
Total	59,000	93,000	+ 34,000
From Germany ...	4,000	6,000	+ 2,000
,, United States ...	36,000	23,000	− 13,000
,, Italy	5,000	50,000	+ 45,000
,, United Kingdom	7,000	10,000	+ 3,000
Insulating tape—			
Total	130,000	109,000	− 21,000
From Germany ...	10,000	5,000	− 5,000
,, United Kingdom	10,000	9,000	− 1,000
,, United States ...	95,000	84,000	− 11,000
Commutators (returned by weight)—			
Total	2,000	180,000	+ 178,000
From United Kingdom	1,000	172,000	+ 171,000
Commutators (returned by number)—			
Total	11,000	14,000	+ 3,000
From United Kingdom	2,000	5,000	+ 3,000
,, Sweden	2,000	4,000	+ 2,000
,, Belgium	1,000	5,000	+ 4,000
Out-outs, safety fuses, and circuit breakers—			
Total	29,000	37,000	+ 8,000
From Germany ...	10,000	12,000	+ 2,000
,, United Kingdom	3,000	5,000	+ 2,000
,, United States ...	7,000	16,000	+ 9,000
Electric bell indicators and telephone switchboards—			
Total (mainly from Germany)	7,000	10,000	+ 3,000
Vulcanised fibre—			
Total	45,000	38,000	− 7,000
From Germany ...	6,000	7,000	+ 1,000
,, United Kingdom	18,000	10,000	− 8,000
,, United States ...	26,000	20,000	− 6,000
Dynamos and motors—			
Total	1,809,000	1,917,000	+ 108,000
From Germany ...	899,000	1,147,000	+ 248,000
,, United States ...	204,000	182,000	− 22,000
,, Italy	135,000	99,000	− 36,000
,, United Kingdom	290,000	173,000	− 117,000
Incandescent lamps—			
Total	439,000	740,000	+ 301,000
From Germany ...	102,000	185,000	+ 83,000
,, Holland	155,000	265,000	+ 110,000
,, United States ...	72,000	140,000	+ 68,000
,, United Kingdom	34,000	38,000	+ 4,000
Electrical material not elsewhere mentioned—			
Total	733,000	1,164,000	+ 431,000
From Germany ...	229,000	297,000	+ 68,000
,, United States ...	263,000	381,000	+ 118,000
,, United Kingdom	118,000	291,000	+ 173,000

Legal.

Breach of Safety Regulations.

At Colwyn Bay last week, Arthur Leadbeater, an employé at one of the North Wales Power Co.'s sub-stations, was summoned for a breach of the Electricity Regulations. Mr. E. M. Rees, Electrical Inspector of Factories, who prosecuted, stated that the defendant was asked by Mr. G. Kirby, an employé of Messrs. Ferguson, Pailin, Ltd., to make a feeder "dead" so that he could do some work at the switchboard. Apparently Leadbeater failed to do this completely, although he gave Kirby to understand that the section was safe. Kirby grasped a conductor under a pressure of 20,000 V and received a severe shock and was badly burned.

The defending solicitor said that the accident was due to a misunderstanding between the two men, although no doubt a technical offence had been committed.

As the Factory Inspector had stated that the Department did not desire a heavy penalty to be inflicted, the magistrates fined the defendant 20s. and ordered him to pay Mr. Kirby's costs.

Crediton Gas Co., Ltd., v. Crediton U.D.C.

The substitution of electric lighting for gas lighting in Crediton, Devonshire, led to an action by the Crediton Gas Company, Ltd., against the Crediton Urban District Council, which came before the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Sargant and Lawrence, on March 8th and 9th, on the appeal of the Gas Company from a judgment in the Chancery Division dismissing the action which the company brought against the defendant Council for a declaration that a notice of April last year given by the Council to the appellant company purporting to determine contracts for the lighting by the company of the Urban District of Crediton was of no effect and inoperative. The Council, however, contended that there was to be implied a power to put an end to the agreement at the will of the Council.

Mr. Justice Russell held that although the agreement did not itself confer on the Council the right to determine the contract, from the nature of the agreement either party had power to determine it upon notice, and as such a notice had been given by the defendants the action failed. He accordingly dismissed the action with costs. At the conclusion of the arguments their Lordships confirmed the decision of Mr. Justice Russell, and dismissed the appeal with costs.

Sun Electrical Co., Ltd., v. Pullen.

In the King's Bench Division on March 12th, Mr. Justice Charles had before him a claim by the Sun Electrical Co., Ltd., against Mr. Oliver E. Pullen, Brondesbury, for £50 for electrical goods supplied. Mr. Guthrie, plaintiffs' counsel, stated that they had also sued defendant's son, Mr. H. E. V. Pullen, dealer in electrical goods, Paddington, for £58 for goods supplied, and judgment had been signed against him. In December, 1924, Mr. Oliver Pullen gave a guarantee under which he held himself responsible until further notice for the payment for goods supplied to his son up to an amount not exceeding £50. The question to be decided was whether the guarantee covered those supplied between February and June last year. Defendant contended that the guarantee had been revoked and that all goods delivered under it had been paid for.

His Lordship, after hearing evidence, said the guarantee was a continuing one, and a letter written by Mr. O. E. Pullen was not and was never intended to be a revocation of his guarantee. Judgment was therefore entered for the plaintiffs for the £50 claimed, with costs.

Etchells, Congdon & Muir, Ltd., v. Eagle, Star and British Dominions Insurance Co., Ltd.

In the King's Bench Division on March 12th, Mr. Justice MacKinnon had before him a special case stated by an arbitrator in connection with a dispute between Messrs. Etchells, Congdon & Muir, Ltd., lift engineers, Manchester, and the Eagle, Star and British Dominions Insurance Co., Ltd., arising out of an accident to a workman while engaged on the construction of an electric lift. Plaintiffs claimed that they were entitled to be indemnified by the defendant company for compensation which they had paid to Thomas Milligan under judgment obtained in Manchester County Court in respect of injuries sustained through being caught in the mechanism of the lift.

For the plaintiffs, Mr. K. E. Shelley said that they held a policy with the defendant company "covering the whole of the employers' legal liability under the Workmen's Compensation Act and the Employers' Liability Act." Milligan, a labourer, was loaned to the plaintiffs by builders who were engaged upon the same building, and defendants contended that he was not claimants' workman, and therefore not covered by the policy. Counsel argued that, although the builders paid Milligan his wages, the workman was in the direct service of the plaintiffs, from whom he took his orders during the period in question.

Mr. Atkinson, K.C., explained that the insurance premiums payable were based on the wages return. The wages paid to Milligan were not returned to the defendant company, and no premium was paid in respect of him.

Giving judgment, his Lordship said that the wording of the policy plainly required payment of premiums in respect of insured workmen, and as no premium had been paid in respect of Milligan, he clearly was not covered by the policy. Therefore claimants were not entitled to recover under the policy.

British Thomson-Houston Co., Ltd., v. Robinson & Barber.

Mr. Justice Russell, in the Chancery Division on March 13th, heard a motion for judgment in default of defence by the British Thomson-Houston Co., Ltd., against Robinson and Barber, New Oxford Street, W.C.

Mr. Tookey, for plaintiffs, said that they claimed an injunction restraining infringement of their patents for gasfilled incandescent electric lamps, and for leading-in wires. There was a general allegation of infringement, and in particular that the defendants sold infringing lamps to a dealer at Blackpool in November last.

His Lordship granted the plaintiffs an injunction, an inquiry as to damages, delivery up of all infringing lamps, and costs.

Electricity Supply to Racing Track.

At a recent meeting of the Stoke-on-Trent Corporation Electricity Committee, the town clerk reported that, provided the Northern Greyhound Racers (Hanley), Ltd., complied with the Electric Lighting (Clauses) Act, the Corporation could not refuse to give the company a supply of electricity. The Committee decided that the company's application be accepted.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Municipalities and Foreign Plant.

Speaking at the recent annual meeting of the London Association of Foremen Engineers, Sir Philip Dawson, M.P., said that British electrical manufacturers even if they cut their prices to make only a bare profit were still unable to underquote their Continental competitors. It was regrettable that municipal authorities were placing contracts abroad, for British plant was so superior in efficiency as to discount any initial saving. Unless something was soon done to safeguard the great British industries they would find themselves very hard pressed in the near future.

A further letter has reached us from a correspondent on the subject of foreign tenders, to which we referred at length in our issue of February 17th, p. 284. The writer, Mr. M. W. Singer, M.Sc.Tech., Assoc. A.I.E.E., takes exception to a statement made at the Birmingham Fair regarding the too great frequency with which contracts are sent abroad. He expresses the quite opposite view that "far too few orders are placed abroad," and regards "the percentage as so small as to be negligible." He adds that the foreign manufacturer keeps down prices and saves our ratepayers many thousands of pounds.

Salford Buys Dutch Cable.

We briefly reported in our last issue that the Salford City Council had placed an order for 16,000 yd. of l.p. cable at £8,080 with the N.V. Kabelfabriek, Delft. At the meeting at which the decision was taken it was reported that the lowest British offer was £8,558.

The Salford Council placed a cable contract with the same concern early last year, and later sent a delegation to investigate wages and conditions in the Dutch cable-making industry.

Sir Philip Dawson, who has recently been championing the cause of British electrical manufacturers in the House of Commons (*vide* our "Parliamentary News"), has written to *The Times* on the subject of the Salford contract. He says: "It does not appear to be sufficiently well realised by the public that, owing to longer hours of work, lower wages, and lower rates and taxes obtaining on the Continent, to make the same profit as the foreigner British electrical manufacturers have to quote 27 per cent. higher prices. Do the ratepayers and electors of Salford realise that the only result of placing orders abroad will be to bring down the standard of living, to increase unemployment, to increase rates and taxes, and to make it more and more difficult for our industries to carry on? It is essential that our home manufacturers should be protected from this unfair competition, which enables the foreigner to dump his goods freely in our market, while tariffs hinder us from selling our goods abroad. There can be no valid excuse for ordering cables abroad, for our manufacturers are second to none as regards equipment, experience, and quality of their products."

The Stockport Contract: Swiss Comments.

In the current issue of the *Schweizer Industrie Zeitung* reference is made to the Stockport steam turbine contract in the following terms: "The 30,000-h.p. steam turbine for Stockport is a standard type, similar to one recently completed by Escher, Wyss & Co., of Zurich, for the municipal power station at Amsterdam, and to one at present in course of construction by this firm for a London power station. The price of £36,000 submitted for the Stockport contract was based on costs of production and as, despite the statement of an English newspaper, labour costs in Switzerland are higher than in England, the prices quoted by the British syndicated turbine builders must have provided for a good margin of profit, especially in view of the fact that when the decision in favour of the Swiss firm was announced, the British firms offered to reduce their price to the extent of £8,000. In this connection it is interesting to observe the price policy of English firms in regard to Continental business. Just recently, Escher, Wyss & Co., despite very keen Belgian, French, and British competition, have been awarded the contract for two 40,000-h.p. steam turbines for a new power station at Sihelle, near Antwerp. The turbines are of a somewhat similar design to that required for Stockport, and the Escher, Wyss Co. worked out its estimate on the same basis as before, only to find that at Antwerp they were underbid by the British makers. Thanks to the extraordinarily favourable results which have lately been attained with Escher, Wyss turbines at several power stations—results which have not yet been attained by British makers with turbines of this type—the Antwerp contract was awarded to the Swiss firm, notwithstanding the lower British offers."

Anglo-American Electrical Relationships.

Two matters which have recently been prominent in the electrical and financial spheres both concern the extension of the activities of American capital in the British electrical industries. The first relates to the activities of the Greater London and Home Counties Trust, Ltd. This Trust has a capital of £300,000, the bulk of which is owned jointly by the directors, Sir Philip Dawson (chairman), Mr. W. May, and Mr. F. Rogers, the remainder being held by these gentlemen separately. It was stated by Mr. May during the Parliamentary proceedings on the East Anglian Electricity Bill that "the Trust was formed by some of his American friends to acquire interests in electricity and other public utility undertakings (*vide* ELECTRICAL REVIEW, May 20th, 1927, p. 820). The acquisition of control of the East Anglian Co. was apparently the first step. It has since been stated that the Trust aims at securing the control of electricity undertakings covering the greater part of Southern England. It is of interest to note that in the above-mentioned Parliamentary proceedings the Counsel for the promoters (Mr. H. P. MacMillan, K.C.) said that "the Trust was not associated with any American or other manufacturing firm, so that there was no danger of orders going to America."

The other matter is a rumour that the General Electric Co., of America, is endeavouring to acquire the business of the Metropolitan-Vickers Electrical Co., Ltd., through its subsidiary, the Electric Bond & Share Co., in order to effect a merger with the British Thomson-Houston Co., Ltd. According to the New York correspondent of the *Financial Times*, Mr. Gerard Swope, president of the General Electric Co., who has recently returned from England to New York, refused to confirm or deny the rumours. On the other hand, in the same issue, our contemporary says that it "has the authority of Mr. Dudley Docker to deny emphatically the report that the General Electric Co. (U.S.A.) is acquiring the Metropolitan-Vickers Electrical Company," of which Mr. Docker is deputy-chairman.

Reference to these matters has been made in our "Stocks and Shares" letters from time to time.

A *Reuter* dispatch, dated March 8th, states: "Although the authorities of the General Electric Company and the Electric Bond and Share Company refuse to confirm or deny the reports from London that their concerns are contemplating large investments in the field of public utility undertakings and electric manufacturing concerns in Great Britain, *Reuter's* correspondent learns from inquiries in other quarters in close touch with the situation that there are indications that the negotiations for such a purpose initiated by Mr. Gerard Swope, president of the General Electric Company, who recently returned to this country from England, are still proceeding. An official announcement on this subject is expected before the end of this month."

United States Electrical Trade.

During December last electrical goods to the value of $10,178,854 were shipped from the United States (as compared with $8,272,864 in December, 1926), making the total value for the year $101,571,685, an increase of $3,881,629 as compared with 1926. Dealing with the December figures, it is seen that the largest increase occurred in the case of accessories and parts for generators—from $97,428 to $963,738. Other notable rises were: Steam turbine generator sets, from $38,699 to $115,996; mining and industrial electric locomotives, from $29,817 to $127,610; flashlights, from $166,361 to $237,460; radio valves, from $67,702 to $106,354; receiving set accessories, from $75,144 to $162,274; carbon furnace electrodes, from $151,066 to $243,444; and insulated copper wire and cable, from $350,274 to $390,287. The principal decreases occurred in: A.c. generators, 2,000 kVA and over, from $196,629 to $77,918; power transformers, from $195,143 to $137,364; other transformers, from $115,683 to $78,924; switches and circuit breakers, over 10 A, from $262,467 to $147,354; and railway electric locomotives, from $72,562 to $35,042. An analysis of the distribution of exports shows that Canada ($1,971,553) was the leading customer, the next in importance being Argentina ($1,411,180), Japan ($722,096), the United Kingdom ($577,183), Australia ($530,333), and Mexico ($522,926).

The electrical imports during December were valued at $185,689, Germany ($63,010) and Switzerland ($57,864) being the principal suppliers. It is noteworthy that while the United Kingdom purchased American electrical goods to the extent of $577,183, American imports of British goods amounted to only $10,067.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electrical Installation Contractors on March 9th:—

Procter, C. F., Hull.
Coop, G. H., Ashton-under-Lyne.
Cassé & Walker, Bradford.
Bailey, N. G., & Co., Leeds.
Hope's Heating & Lighting, Ltd., Smethwick, Birmingham.
Ratcliff, R. P., & Co., Sheffield.
Power Contracts, Ltd., London, S.E.1.
Clutton, W., & Son, London, N.19.
Foggo, J. J., Edinburgh.

At the same meeting four applications were declined.

The Marking of Imported Goods.

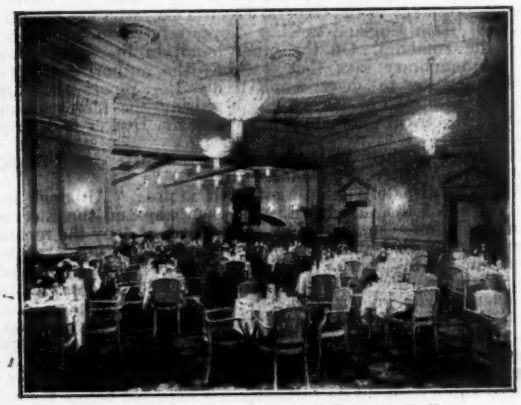
The Board of Trade announces that the Standing Committee (General Merchandise) appointed under the Merchandise Marks Act will hold an inquiry after Easter to ascertain whether imported rubber and manufactures of rubber (including ebonite, vulcanite and manufactures thereof) should be marked with the name of the country of origin. Another inquiry covering imported copper plates, sheets, strips, and other rolled sections, rods and wire (other than insulated wire) will also be held. Communications regarding these inquiries should be addressed to the Secretary of the Committee, Mr. E. W. Reardon, Board of Trade Offices, Great George Street, S.W.1.

The Next E.D.A. Conference.

The British Electrical Development Association has circulated a reminder that the next conference has been postponed for a week, to March 23rd, on account of the annual meeting and dinner to-day (Friday). The subject will be "Personal Salesmanship," by Mr. R. Brymer (Siemens Electric Lamps & Supplies, Ltd.), and the chairman will be Brig.-Gen. R. F. Legge, C.B.E., D.S.O.

Lighting at the "Trocadero."

Recent visitors to the Trocadero Restaurant, W., will have noticed considerable alterations and improvements in the lighting of the Empire and Alexandra Rooms. The new system employed was designed by Mr. O. Bernard, with the collaboration of the General Electric Co., Ltd., by whom the fittings



New Lighting at the "Trocadero."

were supplied. The principal illumination is obtained from large pendant fittings, with a diameter of 3 ft. 6 in., each containing seventeen 40-W lamps arranged in three separately wired sections. Amber-tinted art glass panels are employed to give a warm effect. There are a number of circular ceiling fittings 25 in. in diameter, and round the walls are fittings of similar size, each arranged in the centre of a panel decorated to suggest a "sun burst."

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during January last amounted to a value of £27,514, as compared with £40,934 in the corresponding month of 1927.

The Buenos Aires Subways.

A contract, financed by United States interests, has been signed for the construction of a tunnel leading from the Chacarita station of the Buenos Aires-Lacroze Tramways Company, which works 86 miles of electrically-operated track, to the docks. The estimated cost of the work is 50,000,000 pesos (paper). Fresh negotiations have also been opened between the Anglo-Argentine Tramways Co., Ltd., and the Municipal Council of Buenos Aires for the building of subways urgently required to meet the growing traffic needs of the city. The British company has again offered to proceed with the construction of a second subway, between the Retiro and the Constitución terminal railway stations, a project provided for in its original concession and involving a heavy capital expenditure.—*Reuter's Trade Service* (Buenos Aires).

The Austrian Electrical Industry.

Large dismissals of workmen are expected in the Austrian heavy electrical engineering branch in the near future. It is stated that a crisis has arisen owing to delays in the placing of orders by the communal authorities and the continued uncertainty with regard to the electrification of the railways. The collective agreements in the heavy industry and the cable branch, which have been denounced, have not yet been renewed.

Anglo-Russian Co-operation.

It is reported from Moscow that the administration of the Russian electrical industry has concluded with the Metropolitan-Vickers Electrical Co., Ltd., an agreement in principle with regard to the rendering of technical assistance in the construction of large turbo-generators for the extension of electrical work in the provinces. The orders for the first machines, it is said, are to be placed in England, while later only special parts will be made in England, the bulk being produced by the Leningrad Machinery Trust.

Standardisation and Simplification.

The President of the Board of Trade (Sir Philip Cunliffe-Lister) presided at a meeting held on March 8th, to consider means for the further development of standardisation and simplification. Those present included: Mr. Herbert Williams, M.P., Parliamentary Secretary to the Board of Trade; Mr. Walter Elliot, M.P., Parliamentary Under-Secretary of State for Scotland and a member of the Empire Marketing Board; Lord Gainford, President of the F.B.I.; Mr. Gilbert Vyle, President of the Association of British Chambers of Commerce; Sir Richard Glazebrook; Sir Arthur Balfour; Mr. Maurice Wilson and Mr. C. le Maistre, British Engineering Standards Association; Mr. P. G. Donald and Mr. A. de V. Leigh, London Chamber of Commerce; Sir William Larke, National Federation of Iron and Steel Manufacturers; Colonel Hacking, Society of Motor Manufacturers and Traders; Mr. D. N. Dunlop and Mr. C. Rodgers, B.E.A.M.A.; and Mr. D. A. Bremner, British Engineers' Association. The president reviewed the subject from the Imperial point of view, and mentioned the work done in the United States of America and Germany, by which economies might be effected in many trades by the elimination of unnecessary types of articles, to the consequent advantage of producers, distributors, and users. He suggested that it might be desirable to establish a central committee which would undertake this work. He did not think it could be done effectively by a Government department; what was needed was a representative body in close touch with the various branches of industry. The subsequent discussion showed a general agreement as to the importance of developing standardisation and simplification further than the movement had yet gone in this country, and as to the necessity of having some central organisation of the kind suggested. The meeting requested that a representative of the Board of Trade should act as chairman of the proposed body. It was accordingly decided to set up a Committee under the chairmanship of Mr. Herbert Williams, M.P., consisting in the first instance of the representatives of the Associations enumerated above, together with representatives of Government departments concerned. The first meeting of the new body was fixed for March 27th.

Cable-Making Plant for Canada.

The officer-in-charge of the Trade Commissioner's office at Toronto reports that a local firm of manufacturers is desirous of receiving quotations for machinery for the manufacture of lead-covered copper cable, as follows: Testing equipment, forming press, electric overhead hoist, vacuum drying tank, paper-slitting machine, paper-lapping machine, butt welder, armouring machine, cable laying-up machine, and lead press. Firms in a position to offer British machinery can obtain further particulars on application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1. (Reference A.X. 6013.)

Trade Announcements.

The Armorduct Cable Co., Ltd., has opened a depôt at 38, Bath Street, Glasgow, under the management of Mr. J. A. Paterson, where large stocks of "Armorduct" cables, bell wires, flexibles, &c., are held.

Mr. E. Elwess, managing director of B.E.N. Patents, Ltd., has secured the British manufacturing and distributing rights of a combined automatic and manual traffic-control signalling equipment which is largely used in the United States.

An agreement has been entered into between Automatic and Electric Furnaces, Ltd., and Messrs. Alfred Herbert, Ltd., Coventry, for the sale of "Wild-Barfield" furnaces in Scotland.

The Hoyt Electrical Works (U.S.A.) has appointed Messrs. Fredk. J. Gordon & Co., Ltd., 92, Charlotte Street, W., as agents for Great Britain for Hoyt wireless instruments, automobile electrical equipment, and switchboard instruments.

On and after March 25th the address of Messrs. F. G. Ride & Co. will be 18, Queen Street, off Albert Square, Manchester; goods entrance, 21, Lloyd Street. The telephone number and telegraphic address are unaltered.

Mr. W. A. Gazard has relinquished his position with Messrs. Chamberlain & Hookham, Ltd., in order to start a business as an electrical and wireless contractor. He will be glad to receive catalogues and lists at 80, Victoria Road, Erdington, Birmingham. Telephone 1101 Erdington.

MERSEY CABLE WORKS, LTD., announce that they have recently appointed Mr. T. J. Boorne, of 196, Deansgate, Manchester, their agent for the sale of their wires and cables in the Manchester district, which includes the greater part of Lancashire and Cheshire.

The CREDENDA CONDUITS CO., LTD., has opened new showrooms and offices at 52a, Wellington Street, Leeds.

BRITISH PATENTS & IMPORTS, 15, Basinghall Street, E.C.2, have been appointed sole agents for Great Britain for "Frigid" fans (Union Electrotechnique, Belgium).

The telegraphic address of the Manchester branch of the GENERAL ELECTRIC CO., LTD., has been changed from "Induction" to "Electricity."

The recent change-over from the London Wall Exchange to the automatic Bishopsgate Exchange, included the Main Telegraph Office of Marconi's Wireless Telegraph Co., Ltd., Radio House, Wilson Street, E.C.2, the telephone number of which is now "Bishopsgate 6565."

The Connaught House telephone number of STANDARD TELEPHONES & CABLES, LTD., is now Holborn 8765 (15 lines).

New Catalogues and Lists.

WOODFYT SALES, LTD., 8, Diana Place, Euston Road, N.W.1.—An illustrated price list of wood electric light fittings, including inexpensive patterns.

THE BRITISH REMA MANUFACTURING CO., LTD., Hubert Works, Highroad Well, Halifax.—An illustrated brochure describing the "Rema" pulverising plant.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—March stock list of dynamos and motors.

MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway, N.7.—Leaflets E1.37, dealing with quick-make-and-break flush panel switches, and E1.42, describing the "Marvel" two-light control switch. Illustrated and priced.

MESSRS. T. B. MORLEY & CO., LTD., Jameson Street, Hull.—An illustrated price list of "Morco" shop-window reflectors, and one dealing with domestic lighting fittings in three-ply glassware.

From Messrs. EBONESTOS INSULATORS, LTD., we have received a useful calendar with a block of daily slips mounted on a base of Ebonestos moulding.

MESSRS. W. G. ALLEN & SONS (TIPTON), LTD., Tipton, Staffs.—An illustrated publication dealing with a wide range of electrically-welded and riveted steel plate and pipe work.

MESSRS. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—March list of electrical materials, accessories, and appliances, including domestic heating and cooking apparatus, fans, &c. Illustrated and priced.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, Newman Street, Oxford Street, W.1.—Illustrated folders dealing with "X-Ray" commercial reflectors and the "Trojan" kitchen-lighting unit.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—An illustrated and priced leaflet advertising the company's "Duo-Savelite" lamp.

BRITISH CENTRAL ELECTRICAL CO., LTD., 6 & 8, Rosebery Avenue, E.C.1.—A price list of cables and a leaflet advertising "Koh-i-Nor" adhesive tape and the company's handlamps.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—March calendar-blotter advertising the Jackson "Atom" fire with plug-in element.

MESSRS. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow.—An illustrated leaflet describing the company's face belt tension end.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Publication No. 711, containing an interesting illustrated description of the company's metal-clad oil-immersed switch-fuses for rural area supply.

KORTING & MATHIESEN ELECTRICAL, LTD., 711 and 715, Fulham Road, S.W.6.—Illustrated and priced leaflets dealing with bell transformers and floodlight projectors.

MESSRS. J. COLLIS & SONS, LTD., 43, Regent Square, King's Cross, W.C.1.—An illustrated catalogue of the company's goods-handling trucks.

Bankruptcy Proceedings.

A. H. CRUMP (trading as the Selwyn Electrical Engineering Co.), Walworth Road, S.E.—The first meeting of creditors was held on March 5th at the London Bankruptcy Court, the debtor having filed his petition on February 21st. The Official Receiver reported that the debtor stated that in 1905 he and a brother started a partnership business of electrical engineers under the style of the Selwyn Electrical Engineering Co. Later, in addition to contracting work, they dealt in electrical novelties and radio apparatus. Debtor was afterwards taken ill and unable to attend to business for two months, during which time he employed a manager, and the trading was unsuccessful. During the whole of 1924 he was handicapped by heavy medical expenses for himself and the family. Six months ago he advertised, without success, for a partner, and later sold the business for £150. The debtor attributed his failure to the price-cutting by competitors in the wireless division, the electrical side of his business having been a success throughout. No statement of affairs had been lodged, but the liabilities were roughly estimated at £500, against assets valued at £121. The case was left with the Official Receiver to be wound up in bankruptcy.

L. C. HARVEY, consulting engineer, 25, Victoria Street, Westminster, S.W.—An application for an order of discharge was made on March 2nd at the London Bankruptcy Court by this bankrupt, who failed last April with provable debts of £4,667 and assets of £130. According to the report of the Official Receiver, E.B.C. Electrical Co., Ltd., was registered in April, 1920, to carry on business as manufacturers and buyers of electric lighting sets; the applicant received 3,925 £1 shares of the 50,000 issued to the vendor of the patents for the sets, in consideration of his (applicant's) having found cash capital with which to start the company. He also subscribed for £5,100 preference shares issued for cash, and paid 10s. per share thereon; he refused to pay the remaining 10s. when it was called up and was sued for the amount of the call. He defended the action on the ground of misrepresentation, and judgment was given in his favour, each side agreeing to pay its own costs; the applicant's amounted to about £500, and his total loss on the transaction was £3,050. The applicant then, and still, thought the patent was a very good method of control for regulating the speed of dynamos, and he had received favourable expert advice upon it before entering into the undertaking. The company was wound up in October, 1924. The application was opposed by the Official Receiver on statutory grounds, and the discharge was suspended by Mr. Registrar Francke for three months.

ISRAEL SHAPIN (trading as Penton Engineering Co.), 15, Cromer Street, Gray's Inn Road, W.C.—The public examination of this debtor was held last week before Mr. Registrar Mellor, at the London Bankruptcy Court, the accounts showing liabilities of £7,689, against assets valued at £1,286. The debtor stated that he commenced business as an engineer in 1910. When broadcasting became general he started to deal in wireless accessories, and this became his principal business. He put several inventions on the market and spent a great deal on advertising and exploiting them. In May, 1924, he registered Walco Electrical Co., Ltd., to acquire and carry on the business of an electrical and wireless manufacturing engineer at Highgate Road, Kentish Town, N.; 100 shares of £1 each were issued to him, and he became a director of the company, which he financed. Later he took over all the assets in satisfaction of money owing to him, paid the company's debts and absorbed the business into his own, incurring a loss of £919. Ever since 1925 he had been short of cash capital and had had to get his bills renewed, and to arrange with creditors for the payment of their debts by instalments; in July, 1927, he executed a deed of assignment, but his creditors refused to assent to the deed. The debtor attributed his insolvency to loss in connection with Walco Electrical Co., Ltd.; to bad trade; to depreciation in the value of accessories which became obsolete; and to heavy cost of advertising and printing. The examination was concluded.

H. A. PRATT, Essex House, Lee Road, Dovercourt, Essex, electrical engineer.—The public examination of this debtor was closed on March 8th at the Law Courts, Colchester. The statement of affairs disclosed liabilities of £86, with an estimated deficiency of £68. Debtor commenced business with £10 in March, 1926; he admitted that he had been aware of his position for about three months, but had only contracted one or two small debts since. There had not been much demand for his class of work for some time past. He had continued, hoping to be able to establish a business.

C. L. WEEKS (C. L. Weeks & Co.), electrical engineer, 27a, Charles Street, Newport, Mon.—Receiving order made March 2nd, on debtor's own petition.

LONDON FAN & MOTOR CO., electrical engineers, 81, Charlotte Street, Tottenham Court Road, W.1.—First meeting held March 13th. Public examination, April 27th, both at Carey Street, W.C.

A. C. COOPER, electrical engineer, 1a, Sherwood Street, Scarborough.—First meeting held March 15th, at the Official Receiver's office, 48, Westborough, Scarborough. Public examination, April 17th, at the Court House, Scarborough.

H. C. WINGFIELD, electrician, 47, Carholme Road, Lincoln.—Last day for proofs for dividend, March 22nd. Trustee, Mr. F. C. Brogden, Official Receiver, 10, Bank Street, Lincoln.

E. G. BATT, electrical engineer, 20, Iverna Gardens, Kensington, W., and Magnet House, Kingsway, W.C.—First and final dividend of 3s. in the £, payable March 16th, at 1 and 2, Bucklersbury, E.C.

H. N. SHOROCK, electrical engineer, Holling's Yard, Heysham Road, Morecambe.—Receiving order made March 5th, on debtor's own petition.

J. B. WICKSTEAD, R. J. ALLEN, and L. KNIGHT (C. Cooper and Co.), plumbers and electrical engineers, 26, King Street, Stretford.—Receiving order made March 5th on a creditor's petition.

L. A. DIXON (C. Forgham & Co.), electrical engineer, 23a, Princess Street, and Old Post Office Yard, Shrewsbury.—Receiving order made March 5th, on debtor's own petition. First meeting March 20th, at the Official Receiver's office, 22, Swan Hill, Shrewsbury. Public examination, April 11th, at the Shire Hall, Shrewsbury.

E. M. LANCASTER, electrical engineer, 21, Hanover Lane, Leeds.—Last day for proofs for dividend March 26th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

Dissolution of Partnership.

CROWE & GREEN, electrical engineers, Birkbeck Road, Weston-super-Mare.—Messrs. W. A. Green and R. J. S. Crowe have dissolved partnership. Mr. Crowe will continue the business under the same style.

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Private Arrangement.

Summers & Gould, wireless and electrical dealers, 438, High Street North, E.12.—A meeting of creditors was held on March 9th at the Institute of Chartered Accountants, E.C. Mr. E. C. Randall, 141, Moorgate, E.C., chairman, stated that figures prepared by the debtors showed that there was a surplus of about £109. The liabilities to trade creditors amounted to £770, whilst there were two loan creditors for £128 and £213 respectively. The assets totalled £1,220. The partnership was commenced in June last year, and if the two debtors were given a chance, there was every possibility of the creditors receiving their money in full. When Mr. Gould became a partner, Mr. Summers' assets were valued at £852, whilst the liabilities which then existed amounted to £532, and an amount of £320 was credited to Mr. Summers as his share of the capital. Mr. Randall suggested that a limited liability company should be formed and debentures issued to a nominee of the trade creditors for the amount of their debts, to become payable at short notice. In that event, the two debtors would be able to find further capital to enable the business to be continued. The creditors resolved that the matter should be dealt with under a deed of assignment to Mr. P. S. Booth, Kimberley House, Holborn Viaduct, E.C., as trustee.

The Timber Market.

Our Timber Trade Correspondent reports that whilst stocks of the better qualities of European softwoods are small, with values very firm, the lower grades are plentiful. Spot prices are low in comparison with exporters' rates for cargoes to arrive at the opening of the shipping season in late April or early May. Spot values are hardly likely to recede; they are inclined rather to rise. On the whole, consumption is very disappointing, but improving week by week as the bright weather approaches with better opportunities for outside work. Mahogany and other hardwoods of the better grades are of very firm value, and as stocks are small, prices are likely to advance with any appreciable increase in the demand, which, at the moment, is not as large as it should be. The lower grade hardwoods are of good stock, with prices on the spot somewhat unsteady owing to shippers' prices being on the weak side.

For Sale.

Mr. H. J. Shaw will sell by auction, on March 29th, at 13, High Holborn, various stock comprising wireless sets, electrical accessories, &c. The City of Cardiff Electricity Department has for disposal one 200-kW G.E.C. generator, one l.p. control-panel and e.h.p. truck type switch cubicle. The West Central Merchandise Mart will sell by auction on March 28th, at 10, Red Lion Passage, Holborn, a quantity of v.i.r. and lead-covered cables. By order of Alfred Vernon Power & Engineering Co., Ltd., of Heswall, Messrs. G. N. Dixon & Co. will sell by auction on March 20th, at the works, Irby Road, Heswall, Cheshire, the whole of the electricity generating plant, tools, &c. Colne Corporation Electricity Department invites offer for one Premier water cooling tower, 210,000 gallons per hour capacity. (See our advertisement pages to-day.)

Social Events.

Over 350 people from a very wide area assembled on March 2nd at a highly successful carnival ball held in the Pavilion, Corwen, in aid of the Corwen and District Nursing Association. The ball was organised by Messrs. Siemens Brothers' overhead line construction staff at present engaged in the erection of a 66-kV transmission line from the North Wales Power Co.'s hydro-electric power station at Maentwrog to the distributing centre at Legacy, near Wrexham. The hall was effectively illuminated with hundreds of "Siemens" coloured lamps, which were effectively combined with other decorations that were carried out by members of the staff under the direction of the organising committee, consisting of Messrs. H. W. Taylor, J. L. Watt, W. King, F. W. Martin, C. E. Cousins, and W. E. Poole. Refreshments were served throughout the evening by the Ladies' Committee (Mrs. Martin, Mrs. Thomas, Mrs. Goodwin, Mrs. Prentice, and Miss Roberts). Music was provided by the Llangollen Syncopated Orchestra and the Corwen Mountaineers' Dance Band, and Mr. H. W. Taylor was M.C. A number of prizes, presented by Messrs. Siemens and others, were given for novelty dances.

The Indoor Games Section of the G.E.C. Social and Athletic Club held a dance at Magnet House on February 24th, when some 150 members attended. The arrangements were in the hands of Messrs. H. Fisher and C. A. White.

The staff of the Northwood Electric Light & Power Co. held a social evening and dance on March 3rd. Wherever it was possible to use electricity, electricity was used. Electrically-recorded gramophone records were broadcast through loud speakers by means of an electric gramophone pick-up, and a three-valve amplifier. The covers of junction boxes of a well-known wiring system were pressed into service as ash trays, and electricity played its part in the preparation of the refreshments.

A very enjoyable evening was spent by Polden's Social and Athletic Club (Francis Polden & Co., Ltd.) at a smoking concert held at "The Hour Glass," Upper Thames Street, on March 2nd. The musical items were rendered by members of the Club, and the community singing discovered latent talent for future concerts.

The second annual dinner of Evershed's Social and Athletic Association was held on March 3rd, at Slater's Restaurant, Strand, W.C. Over 120 people were present, including both the managing directors, Mr. E. B. Vignoles and Mr. A. Vines. In an interesting speech Mr. Vignoles traced the progress of the firm from small beginnings up to the present day, when over 600 people are employed. The Association is making similar progress, and this was dealt with by Mr. Vines in his remarks. The Association has a new sports ground at Boston Manor, Hanwell.

The first annual staff dinner of the Wholesale Fittings Co., Ltd., was held at the "Three Nuns" Hotel, Aldgate, on March 3rd, with Mr. John Altman, managing director, in the chair. He proposed the health of the staff, and Mr. John Isaacs, in reply, thanked the directors for a pleasant evening. Mr. F. C. Barnett, director, gave "The Guests," to which Mr. E. Rosen, of Ultra Electric, Ltd., replied. Mr. Stephens proposed the health of the chairman. There was an excellent musical programme arranged by Mr. West.

Porcelain Fittings Rebate Scheme.

The Porcelain Electrical Fittings Association has given notice to its members' customers of a new scale of rebates on purchases of large quantities of goods.

Local Exhibitions.

Aberdeen.—A combined effort is being made by the Corporation Electricity Department, the local electrical contractors, and manufacturers and factors of electrical appliances, to demonstrate at the Music Hall the possibilities of electricity in the home, from April 9th to 16th.

Chippenham.—One of the largest displays at the recent "Happy Homes Exhibition" was that staged by the Western Electricity Supply Co., Ltd., and the West Wilts. Electric Light & Power Co., Ltd. The exhibit was designed to show the many uses of electricity in the home, and cookery demonstrations were given each day. Lectures were given by Mr. A. J. Bridge, general sales and commercial manager, on "Electricity in the Home," in which he dealt fully with its many uses, and gave particulars of the company's easy-payment wiring scheme and tariffs.

Saffron Walden.—Under the auspices of the Borough Electricity Department an electrical exhibition was recently held in the Town Hall. All kinds of domestic appliances were shown, the principal exhibitors being Messrs. E. A. Kett, F. C. Smithers, and T. Johnson & Sons. In opening the display the Mayor (Dr. J. H. Swanton) said that great progress had been made since the supply was commenced in 1925.

A Swedish Company's Report.

The annual report of Allmänna Svenska Elektriska Aktiebolaget shows an increased demand for the company's products, the stock of orders on December 31st being considerably larger than at the end of the previous year. The export market has further developed. An affiliated company named Società Italiana di Elettricità Asea was formed during the year at Milan. The company has resumed the manufacture of electrical machines in Russia, which was interrupted in 1918, and the works at Yaroslavl, which were begun before the Revolution, will now be completed. The board of directors intends to form an affiliated company this year for activity in Russia. The result of the working of the existing affiliated companies has been satisfactory.—*Reuter's Trade Service* (Stockholm).

New French Company.

A new company has recently been formed at Chatillon-sur-Saone (Vosges) with a capital of 625,000 fr., and the title La Société d'Applications des Methodes Modernes d'Eclairage Electrique.

New Indian Companies.

Among the undertakings recently formed in India in connection with electricity supply are the North Bengal Electric Syndicate, Jalpaiguri, Bengal, capital 150,000 rupees; and the Nabadur Electric Supply Co., 10, Canning Street, Calcutta, capital 300,000 rupees.

Unfair Trading.

The question of direct trading has been covered in some detail by us recently both in our leading columns under "What is a Trade Buyer?" and in our "Correspondence" columns. We have now received a copy of a letter received by a firm of manufacturers from one of their agents in which a reprehensible practice which has been brought before us periodically during the past thirty years, is once more referred to. The writer wants to know how the trade generally deals with what he describes as a peculiar case. This is the case :—

"A building is in progress. The contract for the lighting has practically been placed with a regular electrical contractor, when a traveller from another firm enters the picture by approaching the customer direct, offering him trade terms for his fittings, in this case 40 per cent. below the list price, or, in other words, offers the contractors' margin to the customer who is not a recognised trader or contractor, in order to get the business. I should like to know if such methods are recognised by the trade generally; surely there is some way to protect the contractor who, after all, is generally the man to look to from the manufacturer's point of view."

The manufacturing firm mentioned informs us that it has repeatedly had its attention drawn to this matter by its outdoor representatives, and the number of firms following this practice seems to be increasing lately.

Book Notices.

"The Accuracy of Commercial Screw Threads."—This special report No. 4 (Engineering Research) of the Department of Scientific and Industrial Research is to be published to-day (Friday). It deals primarily with an investigation concerning the accuracy desirable in threaded parts of machines, and so on.

"Steam Storage: Greater Productive Efficiency in Industrial Plants," by Alfred J. T. Taylor. (Pp. 56; 28 figs.). London: Ruths Steam Accumulators, Ltd.—This is an attractive brochure dealing in some detail with the principles and employment of the Ruths steam accumulator, which was described in our issue of May 28th, 1926 (p. 807).

"Sell's Directory of Registered Telegraphic Addresses with Telephone Numbers and Classed Trades for 1928." London: Business Directories, Ltd. Price 45s.—With the 1928 issue this useful guide attains its forty-third year of publication, the new and improved system of reference introduced last year is continued, enabling subscribers to find immediately the owner of any registered telegraphic address. Several other useful features are also added, the newspaper press section has been greatly improved, and in addition to 100,000 telegraphic addresses the edition contains a great amount of other useful commercial information.

"How to Build and Operate 'The Wireless World' Moving Coil Loud-speaker," by F. H. Haynes. London: Iliffe & Sons, Ltd. Price 1s. 6d. net.

"Costs for Manufacturers," by C. Smith. Pp. xiii+90. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

"Circulars of the U.S.A. Bureau of Standards." No. 13, United States Government master specification for lamps, electric, incandescent, large, tungsten filament (5 cents).

"Electricity and the Motor Car." By F. H. Hutton. Fifth edition. Pp. xii+136; figs. 109. London: Iliffe & Sons, Ltd. Price 2s. 6d. net.

"Practical Television," by E. T. Larner. Pp. xv+175; figs. 97. London: Ernest Benn, Ltd. Price 10s. 6d. net.

"*Journal* of the Institute of Transport." Vol. 9, No. 5, March. 1928.

The British-German Trade Agreement.

The Minister of Economics, Herr Curtius, announced in the Reichstag on March 6th that the earliest possible opportunity would be taken to give notice to terminate the trade treaty with Great Britain in order "to place our relations with England on another basis." The Minister had previously said that there was reason for dissatisfaction regarding the development of Germany's trade relations with Great Britain, and he was also of opinion that certain measures of the British Government were equivalent to an alteration of the basis on which the trade agreement was founded.—*Reuter* (Berlin).

Radio Patents in New Zealand.

According to the *Auckland Weekly News*, Mr. J. H. Hammond, K.C., chairman of the Federal Royal Commission on Wireless, recently stated that Amalgamated Wireless, Ltd., of Australia, was investigating the validity of the use of certain patented devices by various broadcasting companies in Australia and New Zealand, and it was feared that unless some arrangement were reached litigation would have to be resorted to. It was claimed by the company that no efficient broadcasting station could operate without utilising some patent of which it was the owner. Litigation was already in progress in Australia with regard to the use of patented devices, and it was understood that legal action was threatened in New Zealand. If the Amalgamated Wireless was correct in its contention, the operations of the New Zealand Broadcasting Company would be questioned. If it were true that patented devices were being used some equitable arrangement would have to be made. The company's demands were being disputed vigorously in Australia and there was no doubt the same opposition would be met in New Zealand if action were taken there. The company previously received 12s. 6d. on each valve holder in every receiving set, but as an outcome of the Royal Commission's report nothing was to be received for five years. In the meantime the validity of the patent was to be decided.

Australian Tariff Board's Report.

The report of the Tariff Board set up by the Commonwealth Government, for the year ended June 30th last, states that a large number of public inquiries into various applications were held during that period. Among them were applications for the decrease of the duty on dictaphones; the increase of the duty on copper products, and storage batteries; for the payment of bounties on copper production; and for the gazettal of American induction motors under the Industries Preservation Act (the last is a kind of anti-dumping measure). In the course of the inquiries the Board inspected a number of works, including those of the Electrolytic Zinc Co., and Amalgamated Wireless (Australasia), Ltd., the latter in connection with duties on radio valves. Among the industries which benefited by tariff increases and by deferred duties and for which interests abroad are taking steps to establish factories in Australia in some cases, were radio valves, X-ray apparatus, storage batteries, switchgear, electricity meters, and railway motors. The Board has a wide scope, one of its functions being the investigation "of any other matter in any way affecting the encouragement of primary and secondary industries in relation to the tariff." In pursuance of this the Board considers that there is room for the reduction of designs, sizes and varieties in a number of industries, including storage-battery manufacture. In many cases where duties have been increased, the report says, "instead of the expansion of manufacture the figures reveal rather stagnation." Among these is dynamo-electric machinery, n.e.i., the duties on which "experienced a generous increase with a view to stimulating a languishing industry." While the duties were 30 per cent. British preferential and 40 per cent. general imports were as follows:—1922-23, £949,166; 1923-24, £990,351; 1924-25, £1,037,915. In September, 1925, the rates were raised to 40 and 45 per cent. British preferential and 55 and 60 per cent. general; thereafter the imports were:—1925-26, £1,039,509; 1926-27, £1,040,197. Thus the increased duties failed to afford increased protection, and the report says: "Indirectly also when protection fails to protect, the balance of trade is likely to be adversely affected and this is becoming a serious factor in relation to our financial stability." Although Australian manufacturers strive to maintain a high standard of efficiency, occasionally industries shelter out-of-date plant and methods behind the tariff. In other cases the tariff has been used as a means of securing excessive dividends for shareholders. The requirement that evidence at public inquiries shall be given on oath has succeeded in some measure in eliminating abuse.

Australian Railway Contracts.

According to the Melbourne *Argus*, the Victorian Railway Commissioners have found it necessary to publish a statement dissociating themselves from the action of the Ministry in the awarding of contracts. It is said that Australian firms have not only been given preference beyond the ordinary limit, but have received unfair assistance in the matter of contracts in other directions. One case quoted was a contract for the supply of disk transmission insulators. An American tender was recommended owing to the need for reliable equipment to guard against breakdowns on the suburban railways, but the Ministry insisted on half of the required quantity being purchased from an Australian concern whose products had received only laboratory tests.

Siamese Electrical Imports.

The *Chamber of Commerce Journal* reports that during the year ended March 31st last there was a notable increase in the Siamese imports of electrical goods, especially from Belgium. The total value rose from 814,000 ticals (£74,000) to 924,000 ticals (£84,000). The United Kingdom's share amounted to 621,000 ticals (£56,450).

Recent Contracts.

As we have already briefly reported, Imperial Chemical Industries, Ltd., has recently placed an exceptionally large contract for steam turbines, generators and condensing plant with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD. The contract, which was obtained in the face of severe international competition, is for nine turbo-alternator sets, to form the equipment of a new power station for a large chemical works now under construction for Synthetic Ammonia & Nitrates, Ltd., at Billingham, near Stockton-on-Tees, and is one of the largest orders for power plant ever placed in Great Britain. More than half the total steam to be generated will be used for manufacturing processes, having first of all passed through the high pressure turbines. The plant consists of nine sets, three-phase, 40 cycles, 2,400 r.p.m., 6,300 volts, comprising three 12,500-kW primary sets, three 12,500-kW condensing sets, and three 6,000-kW feed-heating sets. Two sets in each group will be working when the station is on full load, the other set in each group being used as a stand-by. The exhaust steam from the primary sets will be led to a set of steam receivers, whence it will be distributed, the greater portion being taken to various parts of the chemical plant for process work, &c., some to the last stage feed heaters, and the remainder supplying the condensing and feed-heating turbo-alternator sets. To provide for any sudden increase in the quantity of steam required, a set of reducing valves with de-superheaters will be installed under a separate contract as by-passes to the primary turbines. The feed-heating turbo sets will comprise: Three feed-heating turbines, three sets of five-stage vertical feed heaters, four sets of boiler feed pumps, and three sets of heater drain pumps. The whole of the pumps will be supplied by Messrs. Mather & Platt, Ltd., as sub-contractors. The whole of the plant has been designed on lines laid down by Mr. H. A. Humphrey, the consulting engineer to Imperial Chemical Industries, Ltd. It will be erected under the supervision of Mr. T. M. Wilson, chief engineer, and Mr. D. N. Buist, electrical engineer, of Synthetic Ammonia and Nitrates, Ltd.

The OXFORD ELECTRIC CO., LTD., has adopted for each of its large new boilers a single "Harrington" travelling-grate stoker, having 360 sq. ft. active grate surface, and using pre-heated air. Preheated air is also used on three "Harrington" stokers working at Kirkcaldy. A new illustrated catalogue, showing the latest developments in pulverised coal firing, as well as in stokers for direct combustion of untreated coal, will be sent free by the makers of the Harrington stoker, the Riley Stoker Co., Ltd.

Accumulator Companies' Development.

Particulars appear amongst our "New Companies Registered" to-day of the National Accumulator Co., Ltd., which has been formed with a nominal capital of £350,000 to acquire a share controlling interest in the D.P. Battery Co., Ltd., and the Hart Accumulator Co., Ltd. The first directors are:—Mr. B. M. Drake, Mr. W. C. Johnson, Sir John Prestige, and Mr. H. W. Lee.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during February, 1928:—

	Feb., 1928.	Inc. or dec. as compared with Feb., 1927.	2 months, 1928. Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus	340,148	+ 77,978	+ 159,768
Machinery	1,218,420	+136,089	+ 593,698
(Inc. elecl. machinery)	140,376	+ 42,491	+ 60,443
Exports.—			
Electrical goods and apparatus	992,014	+ 26,932	− 124,392
Machinery	4,071,887	+448,676	+1,259,150
(Inc. elecl. machinery)	490,188	− 92,095	− 104,338
Re-exports.—			
Electrical goods and apparatus	12,901	− 1,562	+ 306
Machinery	122,940	+ 19,425	+ 34,558
(Inc. elecl. machinery)	7,873	− 79	+ 1,887

Gold Coast Electrical Imports.

The *Board of Trade Journal* shows that the imports of electrical machinery into the Gold Coast Colony during November last were valued at £19,671, as compared with £1,948 in November, 1926.

Unemployment.

There was a decrease of 27,990 in the number of unemployed during the week ended February 27th. At that date the total was 1,108,700, as compared with 1,136,690 on February 20th and with 1,169,480 on February 28th, 1927.

Prices of Raw Materials.

In their weekly lead report (dated March 10th), Messrs. James Forster & Co. stated:—"The firmness at the beginning of the week was due more to Continental buying than to any increase in demand in this country. It is true that a fair amount of buying has been done here by the Home trade, and cable makers have been in the market for limited quantities, but there is really no evidence of any increase in demand. Arrivals of lead, on the other hand, have been on a small scale, but, notwithstanding this, there is no scarcity, while larger arrivals from Australia and Mexico are expected before long. There are no signs yet of a decrease in production, and until this takes effect it is difficult to find any reason for an advance in price."

Messrs. Lindsay & Williams, Ltd., Bennett Street Works, Ardwick, Manchester, have issued their annual chart showing the course of prices of lead, copper, rubber and cotton during 1927.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report, March 13th: No change in copper prices.

Messrs. James & Shakespeare report, March 13th: English pig lead, £21 5s., 5s. dec.

Messrs. Edward Till & Co. report, March 13th: India-rubber, Para fine, 1s., ½d. dec.

Lighting and Power Notes.

Ashburton (Devon).—Electricity Supply.—The Urban District Council has decided to consent to the Torquay Corporation supplying the district with electricity.

Ashford (Kent).—Loan.—The Urban District Council has applied for sanction to a loan of £11,000 for extensions to the electricity works.

Australia.—Victoria.—The *Electrical Engineer of Australia and New Zealand* reports that the Victorian Government, in a communication to the Ballarat City Council, has stated that it does not propose to renew the franchises for electricity supply and tramway operation held in Ballarat and Bendigo by the Electric Supply Co. of Victoria, Ltd., and in Geelong by the Melbourne Electric Supply Co., Ltd. The Ballarat franchise expires in 1931, the Bendigo one in 1929, and that at Geelong in 1930. The Government is of opinion that it is desirable to extend the State scheme under the control of the Electricity Commission, to take in these cities. At the same time it gives an assurance that the tramways will be kept running, and it suggests that the Councils of the respective cities should meet in conference to discuss their future control.

New South Wales.—The Premier (Mr. Bavin) has decided that the Government should establish an Electricity Commission similar to that existing in Victoria. Mr. Buttenshaw, Minister of Works and Railways, has now interviewed the Railway Commissioner with regard to the proposed scheme. The Minister desires to co-ordinate all the sources of supply and demand with the object of supplying power at a cheaper rate.

Barrow.—Loan.—The Town Council is applying for sanction to the borrowing of £17,500 for electricity purposes, made up as follows:—Mains and services, £15,000; meters, £2,500.

Bessecarr (Doncaster).—Purchase of Undertaking.—The undertaking of the Bessecarr (Doncaster) Electricity Society, Ltd., has been acquired by the Electricity Distribution of Yorkshire, Ltd., for £6,750.

Blackpool.—Loan.—The Corporation is applying for sanction to a loan of £9,500 for meters.

Chelmsford.—Proposal to Purchase Abandoned.—The Town Council has decided to inform the Electric Supply Corporation, Ltd., that negotiations for the purchase of the company's undertaking must be considered at an end.

Cheltenham.—Loan.—At a recent meeting of the Corporation Electricity Committee the borough electrical engineer submitted an estimate amounting to £4,657 for the transformers which would be required in connection with the new bulk supply, and application is to be made to the Electricity Commissioners for sanction to a loan for this amount.

Darlington.—Generating Costs.—The Corporation electricity undertaking claims to generate electricity at a lower cost than any other municipal power station in the country, the figure being .63d. per kWh. Wolverhampton is second with .65d., followed by Sheffield and Rotherham .73d., Manchester .74d., and Leeds .78d.

Glasgow.—Committee of Inquiry.—The Corporation Electricity Committee on Friday (March 9th) considered the question of the reorganisation of the department and the position of the manager, Mr. R. B. Mitchell, in terms of the remit from the last meeting of the Corporation. In his letter to the Corporation, Mr. Mitchell suggested that in any reorganisation of the department a position should be found for him, or, alternatively, that in view of his past services, a solatium should be granted. A long discussion took place on Friday, and the decision arrived at was to set up a Special Committee of Inquiry consisting of seven members and the convener and sub-convener of the Electricity Department. The manager's letter was remitted to the Special Committee to be considered along with the reorganisation proposals. It is suggested that the Committee of Inquiry should deal expeditiously with Mr. Mitchell's letter and inform the Corporation of its decision as soon as possible. It is learned that on Friday a member of the Committee proposed that the resignation of the manager should be accepted, but, after discussion, this suggestion was withdrawn, and it was agreed that he should remain in his position until further notice from the Committee. It was decided to take no action with regard to the communications from the Associated Municipal Electrical Engineers and the Glasgow Branch of the National Association of Local Government Officers. For the benefit of those members who had not had an opportunity of reading the shorthand notes of the first inquiry, a copy was presented to each, and they will have a week in which to consider this before commencing the new inquiry. It should be noted that only three of the Special Committee elected on Friday were members of the original Committee of Inquiry.

Guildford.—Electricity Supply.—The Town Council has applied for sanction to a loan of £47,000 for the development of the electricity undertaking. The sum includes £3,980 for transformers and switchgear, £26,050 for transmission mains, £1,620 for feeder mains, £2,650 for sub-stations, £4,910 for sub-station equipment, £1,090 for transformer kiosks, and £7,350 for distributing mains. A main is to be run to the boundary of the Guildford and Dorking electricity areas near Abinger for the purpose of giving a bulk supply of electricity to the Cranleigh Gas and Electricity Co., Ltd.

Horsham.—Loan.—The Urban District Council is applying for sanction to loans of £12,673 for new plant, and £3,800 for buildings.

Irish Free State.—The Shannon Scheme.—In a report which has just been issued the Electricity Supply Board of the Irish Free State outlines its plans for the distribution of the Shannon energy, which will become available next year. According to *The Times*, the report states that a start will be made in Dublin, where the existing network will be used. The municipal undertaking will connect its transformer station with that which is being built by the Shannon Board, and the work of switching over will present no difficulty. Cork and Limerick will be tackled almost immediately, while the Board is negotiating for the acquisition of the authorised undertakings in Dundalk, Wexford, and Clonmel. In the opinion of the Board the interest of the country will be served best by the acquisition of all existing undertakings by the State. The Board has mapped out an ambitious programme for the electrification of some 130 towns and villages in the Free State where electricity is not at present available. Furthermore, the Board has adopted a comprehensive scheme whereby householders will be assisted to wire their houses on the instalment system, and a national census is being taken of all the electricians and electricians' apprentices in the Free State in order that the problem of skilled labour may be solved with the minimum delay. It is expected that the electrification of the Free State will be in full swing by the middle of next year, and in order to ensure the success of the Shannon scheme the Board is preparing an extensive publicity campaign which will bring the benefits of electricity in the home and on the farm before the notice of the people.

Leyton.—Electricity in Small Houses.—The Town Council has decided to adopt the following scheme for the supply of electricity to small houses:—The hire of a complete installa-

tion, including lamps and shades up to six lights, of any size up to a maximum of 60 watts, and the supply of a new lamp for every 50 kWh consumed, at a fixed charge of 6s. per quarter, and 6d. per kWh.

Liverpool.—LOAN.—The City Council has received sanction to the borrowing of £300,000 for prospective expenditure on mains.

REVISED CHARGES.—The following amended scales of charges for electrical energy are now operative in the city, the borough of Bootle, and urban district of Litherland:—Ratable-value charge: (Section A, for all purposes)—a fixed quarterly charge of 3½ per cent. on the ratable value of the premises (not being a private house), and 1.2d. per kWh; (Section B)—for private houses only, a fixed quarterly charge on the ratable value of the premises of 2½ per cent. and 1.2d. per kWh. (Section C)—for private houses only, a fixed quarterly charge of 5 per cent. on the ratable value of the premises with a minimum assessment of £18 and not exceeding £75, plus 2½ per cent. on excess of £75 assessment, and ½d. per kWh, and for water heating up to 500 kWh per quarter, ½d. per kWh, and over 500 kWh per quarter, 3/10d. per kWh.

RATE RELIEF.—The City Council has decided to transfer £35,000 from the electricity supply account to the relief of the rates.

London.—SHOREDITCH.—The Electricity Committee has recommended that an additional 1,500-kW convertor be installed at Evelyn Street sub-station, and application is to be made for sanction to a loan of £9,214 for this purpose.

Long Eaton.—LOANS SANCTIONED.—The Urban District Council has received sanction to a loan of £10,000 for mains and services.

Maidstone.—LOANS.—The Town Council has received sanction to a loan of £6,597 for the erection and equipment of a sub-station in Foster Street and for mains extensions. Sanction to further loans of £2,793 in connection with a supply of electricidty in the Loose area, and £7,647 for a supply to the Bearsted area, has ben applied for.

Manchester.—LOAN.—The Corporation is applying for sanction to a loan of £50,000 for distributing stations.

PROGRESS DURING JANUARY.—During the month of January the Corporation electricity undertaking showed an increase in connections of 2,241 kW, bringing the total up to 338,655 kW; and the number of applications received for supply, including consumers for additional supplies, was 1,168, representing a total of 2,288 kW. The number of hired cookers connected increased by 61, bringing the total actually on circuit to 4,137. Applications for the hire of cookers totalled 92. An additional 1,500-kW motor convertor was installed at Ancoats sub-station.

Oldham.—LOAN.—The Corporation Electricity Committee is applying for sanction to the following loans:—Coal handling plant, £6,845; cooling towers, water tanks, &c., £33,900; railway sidings, £9,512.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

ERITH.—Lighting: Quarterly, from 5d. to 4½d. per kWh; prepayment, from 5½d. to 5d. per kWh.

KETTERING.—Lighting: Winter quarters, from 6½d. per kWh for the first 300 kWh per quarter, and 5d. beyond, to 6½d. for the first 200 kWh per quarter and 5d. beyond; summer quarters, from 6½d. for the first 150 kWh per quarter, to 6½d. for the first 100 kWh, and 5d. beyond. Heating: From 1½d. to 1d. per kWh. Two-part tariff and "all-in" scheme: The running charge from 1½d. to 1d. per kWh. Outlying districts: The percentage increase for power reduced from 20 to 5 per cent., and for purposes other than power, from 20 to 15 per cent.

SALISBURY.—*Salisbury Electric Light and Supply Co., Ltd.*—Lighting: First 100 kWh per quarter, 7½d. per kWh; next 100 kWh, 7d.; beyond this amount, 6½d. per kWh.

Sheffield.—NEW PLANT.—The Corporation Electricity Committee has received sanction to the extension of the generating station at Blackburn Meadows by the installation of one 25,000-kW, three-phase, 50-cycle turbo-alternator and three 120,000-lb. boilers, with the necessary additions to buildings.

Southampton.—RATE RELIEF.—The Corporation Electricity Committee is to contribute £8,500 from the profits of the undertaking for the year ending March 31st next to the relief of the rates.

Southend-on-Sea.—INQUIRY.—An inquiry was opened by Col. T. C. Ekin, on behalf of the Electricity Commissioners, on February 28th, and continued during the following two days, into the application of the Corporation for a Special Order authorising it to extend its area of electricity supply to include the Rochford rural district, and the Canvey Island urban district, and for consent to extend the London Road power station by one 1,200-kW Diesel set with accessories, at an estimated cost of £41,463. Objections were raised by the County of London Electric Supply Co., Ltd., and the Rochford Rural District Council. For the Corporation it was stated that Mr. Selvey, consulting engineer, had planned a ring main from Leigh to Hadleigh, continuing to Rayleigh, Hockley, and Rochford, and returning to London Road station. From a short link from Thorpe Bay a supply could be given to Shoeburyness, if desired. For the company it was stated that it proposed to provide a h.p. line between Tilbury and Southend which would be available for affording a supply in the rural area. The Rochford Council claimed that the company could give a more efficient service. Regarding the application for sanction to install additional plant at the London Road station, the Corporation said it was necessary to provide spare plant to allow one station to come to the assistance of the other. This proposal was opposed by the County of London Company, which was prepared to provide a bulk supply if the Corporation withdrew its application to extend its area of supply. The Commissioners will give their decision in due course.

Southport.—NEW PLANT.—The borough electrical engineer has reported to the Electricity Committee that the new 7,000-kW set has had its initial run, and the new cooling tower has been in operation, and both items are expected to be in commercial service this month.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Council of Ashbourne authorising it to supply electricity in the urban district, and parts of the rural districts of Ashbourne and Sudbury; the West of England Electricity, Ltd., to supply electricity in the urban districts of Wivelscombe, Ottery St. Mary, Crewkerne, and Ilminster, the borough of Honiton, the rural districts of Culmstock, Tiverton, Dulverton, and Wellington, and parts of the rural districts of Axminster, Crediton, Honiton, St. Thomas, Chard, and Beaminster; Warrington Corporation to supply in parts of the rural districts of Warrington and Runcorn; and Tonbridge Corporation to supply in parts of the rural districts of Tonbridge, Sevenoaks, and Uckfield.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The developed water power in the United States at January 1st was rated at 12,296,000 h.p., showing an increase of 575,000 h.p., or approximately 5 per cent. during 1927; and the total amount of potential water power available 90 per cent. of the time is 38,110,000 h.p., and that available 50 per cent. of the time is 59,166,000 h.p., according to an announcement by the Department of the Interior, through the Geological Survey.

Power states that the figures for potential water power are not directly comparable with the figures for developed water power, because the latter are given in terms of the capacity of the installed waterwheels, which may be several times the potential power available 90 per cent. of the time. Estimates based on studies of the capacity of waterwheels installed at fully developed water-power sites indicate that about 15 per cent. of the potential water power of the United States is developed at the present time. All the increase in developed water power in 1927 was in the plants of public-utility power companies. California still ranks first in developed water power, with a total of 1,993,000 h.p. of waterwheels in water-power plants. New York, with 1,779,000 h.p., is second, and Washington, with 707,000 h.p., is third. The estimate of potential water power in the United States has been revised to include the results of recent studies and surveys, particularly in the upper Columbia River basin and the Tennessee River basin. Washington, with 11,200,000 h.p. available 50 per cent. of the time, leads all the States in water-power resources by a wide margin. It is followed by California with 6,700,000 h.p., Oregon with 5,900,000 h.p., and New York with 5,000,000 h.p., these figures representing power available 50 per cent. of the time at an efficiency of 70 per cent. Most of the undeveloped power in New York is on the Niagara and St. Lawrence rivers.

Wallasey.—ELECTRICITY SUPPLY PROGRESS.—The Corporation has received sanction to a loan of £38,000 for extensions to buildings and plant at the generating station. During the month of January the output was over 4,000,000 kWh, an advance of about 13 per cent. on the corresponding month of last year. The number of radiators, motors, &c., in use was 8,200, and the number of consumers totalled 11,620.

Winchester.—LOANS.—The Town Council has applied for sanction to the following loans:—Mains and services, £5,000; new feeder cable, £3,260; meters, £2,500.

Tramway and Railway Notes.

Blackpool.—LOAN.—Application is being made by the Corporation for sanction to borrow £20,000 for ten single-deck tramcars.

Continental.—BELGIUM.—The Société Nationale des Chemins de fer Vicinaux has decided to proceed with the electrification of its local railway system in the Mons, Binchi, Bray, and Symphoriend districts.

FRANCE.—The Midi of France Railway Co. has prepared the necessary plans for the electrification of its branch railways between Puyoo, Mauleon, and Saint Palais, a distance of about 35 miles, and between Bayonne, Saint Jean-Pied-de-Port, and Saint Etienne-de-Bargory, 38 miles. The lines will link up with the Midi Co.'s main system at Puyoo and Bayonne.

ITALY.—A meeting of representatives of chambers of commerce and communal authorities has lately been held in Milan, when it was decided to urge the Italian Government to proceed at an early date with the electrification of the railway

from Chiasso, on the Swiss frontier, to Milan. The Swiss main line from Basle to Chiasso is now completely electrified, and it is urged that the proposed electrification of the continuing Italian system is but a natural development, which would be of great assistance to Como and other places in Northern Italy.

East Ham.—TRACK RENEWALS.—The Corporation has approved plans and estimates submitted by the borough engineer for the reconstruction of the tramway track and highway margins in Plashet Grove from High Street North to Green Street, amounting to £34,863, including the widening of the highway and duplication of the track from High Street North to Katherine Road and from Grangewood Street to Green Street.

Glasgow.—ELECTRICITY SUPPLY.—Mr. Lachlan MacKinnon, general manager of the Tramways Department, issued a report on Saturday last to the Tramways Committee on the question of the supply of power for the tramways. He suggests that with certain additions at the Pinkston power station (tramways) it is possible for the Department to take all its power from there; the Electricity Department, on the other hand, contends that the best course for the Corporation is to close Pinkston and to take supplies from the Dalmarnock station of the Electricity Department. The latter is prepared to supply power to the tramways at 0.3793d. per kWh. The estimated cost of the Pinkston scheme is £237,000. Mr. MacKinnon says that the rotary plant in the sub-stations has been well maintained and has an efficient life of at least 20 years. Only £75,000 is required for a new generating set at Pinkston, and the balance is for replacing boiler plant, switchboards, &c. No satisfactory evidence has been furnished that the Tramways Department or the Corporation will be in any way advantaged if the tramway power load is brought under the scheme of the Electricity Supply Act of 1926. On the contrary, Mr. MacKinnon thinks there is everything to gain by remaining outside the scope of the Act. The question of power cannot with safety be longer delayed; the large set at Pinkston is working regularly beyond its normal rated capacity, and any breakdown will mean a stoppage of the tramway system. Under the new arrangement, Mr. MacKinnon adds, the saving in coal will pay off the cost of the new set in less than six years. He estimates that it would involve the Tramways Department in an expenditure of over £400,000 to alter the existing plant to 50 cycles, without any provision for further extension.

Japan.—UNDERGROUND RAILWAY.—The Japan Electric Railway Co. has received a charter for the construction of an underground electric railway between Tokyo and Osaka.

Liverpool.—RATE RELIEF.—The City Council has approved a recommendation that a sum of £115,000 be transferred from the tramway accounts to the relief of the rates.

London.—NEW "UNDERGROUND" CARS.—In connection with the alterations and improvements now being made to Underground rolling stock, the Underground Railways have placed contracts with British firms for new car bodies, bogies, traction motors, and control equipments for the District, Hampstead and City, and Bakerloo lines. With the exception of 112 new cars for the Hampstead line, the rolling stock will replace old cars now in service. It is hoped to have a large proportion of the new equipment in use by the end of the year, and the remainder early in 1929.

Manchester.—NEW TRAMWAY.—The Corporation Tramways Committee has passed a plan of a proposed tramway between the Northenden Road (Sale) terminus and Palatine Road, Northenden, as an alternative to the authorised tramway under the Manchester Southern Tramways Act, 1903, and it is to be forwarded to the Sale Urban District Council for its consent.

Northampton.—ABANDONMENT OF TRAMWAY.—The Corporation Tramways Committee, which has had under consideration for some time past the question of relaying the Wellingborough Road tramway track or the substitution of motor-omnibuses for tramcars over that route, has now recommended that the track be not relaid, but that in due course motor-omnibuses be substituted for tramcars on this route.

Sheffield.—LOANS SANCTIONED.—The Corporation has received sanction to the borrowing of £25,935 for the construction of the Meadow Head tramway, and £1,696 for electrical equipment.

Southampton.—RATE RELIEF.—The Corporation Tramways Committee proposes to allocate a sum of £8,000 from the profits of the undertaking for the year ending March 31st last to the relief of the rates.

Southend.—RAILLESS CARS.—At a meeting of the Corporation on March 6th, a recommendation was submitted by the Light Railways and Electric Lighting Committee that a railless-car service be provided on two additional routes, at an estimated cost of £39,720. After considerable discussion the proposal was defeated.

Southport.—TRACK RENEWALS.—The Town Council has approved the recommendation of the Tramways Committee for the relaying of a section of the tramway track, at a cost of £16,500.

Telegraph and Telephone Notes.

Australia.—POSTMASTER-GENERAL'S REPORT.—The report of the Australian Postmaster-General for the year 1926-27 shows a loss of £172,000, as compared with a loss of £285,000 in the previous year. During the year international messages containing 4,418,000 words were dispatched *via* the Pacific cable and 3,940,000 words were received, yielding a revenue of £66,000, as compared with £72,000 in the previous year. Over the Eastern Extension cable messages containing 5,533,000 words were dispatched and 5,645,000 words were received, yielding a revenue of £114,000, as compared with £121,000 in the previous year. From the inauguration of the "beam" wireless service on April 8th, 1927, to June 30th, 1927, 760,000 words were sent from Australia and 571,000 received. The report adds that because of its high speed, great capacity, and other considerations this service has materially strengthened the chain of Empire communications.—*Reuter* (Canberra).

"BEAM" WIRELESS.—The Canberra correspondent of the *Daily Telegraph* reports that Senator Thomas, on March 9th, moved a resolution that plain language messages by "beam" wireless should be charged at 1d. per word. He said that at this rate the traffic would increase to 50,000,000 words annually, which would yield a revenue of £208,000. As the company paid £8,000 in the expenses of running the traffic, there was no reason why with a penny a word it should not make ends meet. If necessary, the Government should take over the business. The debate was adjourned.

France.—TELEPHONE DEVELOPMENT.—Negotiations are in progress with regard to the establishment of new telephone cables between Lyons and Turin and between Lyons and Geneva.

Hungary.—WIRELESS SETS ON TRAINS.—A wireless telephone company has been founded for the purpose of installing receiving sets on the trains of the State railways and also in the waiting rooms at the big stations.—*Reuter's Trade Service* (Budapest).

Radio Communication.—DEVELOPMENT IN AMERICA.—The report of the Radio Corporation of America for the year ended December 31st last states that a reliable system of high-frequency directive transmission, known as the R.C.A. Projector System, has been developed by the engineers of the Corporation, and is now in operation on several circuits. This system, in efficiency, compares most favourably with the performance of the Marconi "beam" system, and offers some advantages in simplicity of construction and adjustment. The latest developments in short-wave radio communication have been made available in the A. E. F. G. consortium of stations in Argentine and Brazil, in which the R.C.A. is a partner, and increased efficiency has resulted. The development of the "Projector" system is the patent of the R.C.A., and companies owning other stations, which may use it in the future, will have to do so on some arranged formula with regard to royalties.

Radio Direction-Finding.—NEW SYSTEM.—Mr. H. G. Williams, M.P., Parliamentary Secretary to the Board of Trade, recently referred to a new invention of wireless direction-finding by the rotating loop system, which was likely to revolutionise methods of navigation. He said up to now the proportion of ships fitted with wireless direction-finders was small, but that number was steadily increasing. Experiments were now being carried out with the rotating loop system which, if expectations were realised, would place wireless direction-finding at the disposal of ships which were equipped with ordinary wireless apparatus.

The Congo.—TELEGRAPH AND TELEPHONE DEVELOPMENT.—An agreement has been arranged between the Government authorities of French Equatorial Africa and the Belgian Congo for the laying of telegraph and telephone cables across the Congo river between Brazzaville on the one side and Kinshasha-Leopoldville on the other.

The Telephone Service.—NEW EXCHANGE.—The new "Terminus" telephone exchange was opened on March 7th. This exchange will relieve the pressure on Museum and Fitzroy exchanges. Over 800 subscribers in the Gray's Inn Road and King's Cross district have been transferred to the new exchange.

A new automatic telephone exchange building, which has been erected at Thorn Bank, High Street, Edgware, was brought into use on March 8th. Central battery type equipment has been installed to maintain development pending the completion of the new automatic exchange.

The Telegraph Service.—TELEGRAPH COMMITTEE'S REPORT.—The *Central News* Lobby Correspondent reports that the Committee on the Inland Telegraph Service appointed by the Postmaster-General last July has completed its inquiry. It is understood the Committee's report does not succeed in putting any definite complexion on the prospects of the telegraphs becoming a paying service.

Transatlantic Telephony.—LONDON-HALIFAX.—The extension of the transatlantic telephone system from London to Halifax, Nova Scotia, came into operation on March 9th. The new extension is operated in the usual way to New York and by land line thence to Halifax, a distance of about 4,000 miles.

LONDON-WINNIPEG.—The Winnipeg correspondent of *The Times* reports that direct telephone communication has been established between Winnipeg and London. It is expected that in the near future the service will be extended to France, Germany, and other European countries. The calls are made *via* Chicago, but should the system proposed by Marconi's be established to Canada, Winnipeg will be able to communicate with London by an all-Canada route, as direct telephone connection with Eastern Canada will be established next month.

LONDON-VANCOUVER.—The Vancouver correspondent of *The Times* reports that a wireless telephone service between Vancouver and Great Britain was inaugurated on March 8th, constituting the longest commercial telephone link in the Empire. Conversations are relayed through Seattle, Chicago, New York, and Cupar, Scotland. The rates charged are $57 (£11 8s.) for the first three minutes, and $19 (£3 16s.) for each additional minute. Previously the longest telephone call was from Vancouver to Cuba, a distance of 6,200 miles, which was made over land lines.

Radio Notes.

Australia.—LICENCES.—In his report for the year 1926-27, the Postmaster-General states that there were 225,000 wireless licences in existence, of which 119,000 were in Victoria. The fees amounted to £307,000.—*Reuter* (Canberra).

BROADCASTING.—The general manager of the Broadcasting Company of Australia Pty., Ltd. (3LO), Melbourne, has announced details of a new plan for investigating atmospherics, or static, and wireless fading shortly to be undertaken by 3LO. The Wireless Institute of Australia will co-operate in the experiments, which will show, in a general way, where static and fading are at their worst.

It is reported that the Postmaster-General's Department is endeavouring to persuade the private broadcasting companies in Australia to co-operate with the object of saving unnecessary expenditure and improving the broadcasting services all round. The Department thinks it possible, by effective co-operation, to save £30,000, which might put non-paying stations on a sound basis. The suggestion for co-operation came originally from the Royal Commission on Wireless, which discovered an unequal state of affairs in the relations of stations in the Commonwealth. The Commission suggested that the revenue of all stations be pooled and that £5,000 operating expenses be paid annually to each station.

A Roman Catholic broadcasting station established at the Eucharistic Congress office, St. Mary's Cathedral, Sydney, has been given a thorough test. The new station is working in conjunction with 2UE, Randwick, a "B" class station, and it is stated that 2UE has been specially leased for the Eucharistic Congress to be held at Sydney this year.—*Reuter's Trade Service* (Melbourne).

Hungary.—BROADCASTING.—Arrangements are being made to increase the power of the Vienna station, and it is stated that the new Budapest station will be more powerful than the existing one. The number of radio subscribers in Hungary is 800,000, the bulk of whom are in the Budapest area.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Aylesbury.—Electricity Department. Twelve months' supply of cable, ironwork, l.p. insulators, a.c. meters, poles, joint boxes, cutouts, &c. (See this issue.)

Barnes.—Electricity Department. H. and l.p. cables. (March 2nd.)

Bexhill.—March 22nd. Electricity Committee. 11,000 yd. .05 sq. in 11,000-V cable. (March 9th.)

Bolton.—March 19th. Board of Guardians. Electric lamps required during six months. Form of tender from Mr. H. I. Cooper, clerk to Guardians, 28, Mawdsley Street, Bolton.

Chichester.—March 23rd. West Sussex County Mental Hospital, Graylingwell.—Electric lighting sundries for a year. Particulars from the Hospital clerk and steward.

Crediton.—March 28th. Board of Guardians. Installation of electric lighting at the Poor Law Institution, Western Lodge, Crediton. Specifications from the Master at the Institution.

Edinburgh.—Midlothian and Peebles Board of Control. Supplying Rosslynlee Asylum with electrical fittings for six months. Forms of tender from Mr. C. L. Addison-Smith, clerk and treasurer, 19, Heriot Row, Edinburgh.

Egypt.—CAIRO.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1. 3-core h.p. and l.p. armoured cable, transformer, h. and l.p. switchgear. 10,000 metres lead-covered conductor cable.

April 12th. Ministry of the Interior. Diesel engine alternator set for Suez electric light station. (B.X. 4252.)*

Erith.—March 22nd. Electricity Department. H.p. and l.p. cables, joint boxes, and accessories. (March 9th.)

Glasgow.—March 17th. Education Authority. Installation of electric lighting in new infant department, Shawlands Secondary School. Specifications, &c., from Education Offices (Property Department), 129, Bath Street (deposit of 10s. 6d.).

March 26th. Corporation. Installation of electrical passenger lift at buildings in Trongate and Stockwell Street. Public Works office, 64, Cochrane Street.

Hoylake.—March 24th. Electricity Department. Motor-generator and switchgear. (See this issue.)

India.—March 23rd. South Indian Railway Co., Ltd. L.p. cables and switchgear. (March 9th.)

March 29th. Indian Stores Department, New Delhi. One 70-kW 120-V d.c. steam-driven generating set. (B.X. 4256.)*

South Indian Railway Co. Power wiring cables and accessories. (See this issue.)

Irish Free State.—DUBLIN.—April 4th. Electricity Supply Board. Erection of overhead electricity distribution mains and services in Celbridge, Kelcock, Maryborough, Maynooth, Mountmellick, Naas, Newbridge, and Rathaugan. (March 9th.)

March 24th. Borough Commissioners. E.h.p. and l.p. cables, cast iron and stoneware troughing section pillars, compound, &c. (March 2nd.)

Irvine (Ayrshire).—March 26th. Town Council. Electric lighting at ten blocks of houses. Specifications (one guinea deposit) from Mr. A. R. Wilson, town clerk, Council Chambers, Irvine.

London.—METROPOLITAN ASYLUMS BOARD.—March 21st. General engineering work, including steam plant, steam and condense mains, h.w.s. mains and apparatus, motor drives, &c.; installation of four new Lancashire boilers; installation of new fuel economiser; brickwork settings for four boilers and economiser; installation of electric lighting, power and telephones at Caterham Mental Hospital. (February 24th.)

ST. MARYLEBONE.—March 19th. Board of Guardians. Automatic intercommunication telephones at the St. Marylebone Hospital. (March 2nd.)

LONDON COUNTY COUNCIL.—April 16th. E.h.p. switchgear for Greenwich Power Station. (March 9th.)

Manchester.—March 19th. Electricity Committee. L.p. water pipework and supports, also dismantling of similar pipework at Stuart Street power station. (March 2nd.)

March 26th. L.p. water and oil pipework, &c., for auxiliary services (Section B), Barton power station. (March 2nd.)

April 4th. Electric radiators. (See this issue.)

March 21st. Waterworks Committee. Two electrically-driven multi-stage centrifugal pumps, with automatic switch and control gears, pipes, valves, &c. Specifications from Engineer, Waterworks Offices, Town Hall. Deposit £1 1s.

Middleton.—March 20th. Town Council. L.p. tramway feeder cable. Specification and form of tender from Borough Electrical Engineer, Corporation Street. Deposit £1 1s.

New Zealand.—WELLINGTON.—April 17th. Post and Telegraph Department. Head receivers. (B.X. 4239.)*

Norwich.—March 26th. Electricity Committee. Erection of 16 miles of 33,000-V overhead line. (March 9th.)

Rhondda.—March 31st. Electricity Department. Twelve months' supply of meters, cables, joint boxes, compound, cutouts, &c. (February 24th.)

South Africa.—JOHANNESBURG.—April 24th. Town Council. Two 10,000-kW turbo-generators, with condensers. (B.X. 4266.)*

April 26th. A.c. and d.c. house-service meters. (B.X. 4262.)*

Stafford.—March 29th. Education Committee. Installation of electric lighting at Brierley Hill, Mill Street Schools, &c., and at the Girls' School, Tamworth. (March 9th.)

Warrington.—March 20th. Board of Guardians. Electrical supplies for six months. Mr. A. Bottomley, clerk, Museum Street.

West Bromwich.—March 21st. Walsall and West Bromwich Unions Joint Committee. Cables in connection with building extensions at Great Barr Park Colony. (March 2nd.)

West Lothian.—March 31st. Education Authority. Electrical work at the new Technical and Roman Catholic Schools, Bathgate. Specifications (one guinea deposit) from Mr. Blades, executive officer, Education Offices, Bathgate.

Whitehaven.—March 26th. Rural District Council. Overhead cable, street-lighting fittings, and internal wiring of 183 houses, St. John, Thornhill. Mr W. J. Goode, surveyor, Union Hall.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—Sydney.—Civic Commissioners. Accepted :—
Gasfilled electric lamps.—Lawrence & Hanson Electric Co. (£3,571); Australian General Electric Co., Ltd. (£69).
H.p. single-conductor cables (£817).—Enfield Cable Works, Ltd.
Transformer and switch-oil treating plant (£333).—Australian Westinghouse Co., Ltd.
Spare blading for turbo-alternator set (£1,851).—Metropolitan-Vickers Electrical Co., Ltd.
—*Tenders.*

Melbourne.—Victorian Railways. Accepted :—
200 miles of Semaphite signal wire.—Johnson & Phillips, Ltd.

Billingham.—Imperial Chemical Industries, Ltd.
Nine turbo-alternator sets (approx. 93,000-kW capacity), with condensing plant, for the Synthetic Ammonia and Nitrates, Ltd., new power station.—Metropolitan-Vickers Electrical Co., Ltd. (See our "Business Notices" pages to-day.)

Bishop Auckland.—Durham County Council.
Electrical installation at the Bishop Auckland police courts (£125).—Kelly & Co.

Burton-on-Trent.—Electricity Committee. Accepted:—
Cable for extension of 3-phase main to Dallow Street (£2,101).—Johnson & Phillips, Ltd.
Switchgear for Blakeholme Street sub-station (£570).—Crompton-Parkinson, Ltd.

Dewsbury.—Town Council. Accepted :—
Wiring houses at Laithe Croft, Earlsheaton, for electric lighting (£169).—Mr. W. Angus.

Doncaster.—
H.p. cables (£2,907).—Callender's Cable & Construction Co., Ltd.
L.p. cables (£2,849).—Enfield Cable Works, Ltd.

East Ham.—Electricity Committee. Recommended :—
Feeder switch panel in connection with bulk supply to West Ham (£224).—A. Reyrolle & Co., Ltd.
A.c. extension panel at Manor Park sub-station (£187).—Yorkshire Switchgear and Engineering Co., Ltd.
Tramways Committee. Recommended :—
Ten tramcar bodies, top covers, seating, trucks and brakes (£19,330).—Brush Electrical Engineering Co., Ltd.
Ten motors, controllers and electrical equipments (£4,942).—British Thomson-Houston Co., Ltd.

Hastings.—Watch Committee. Recommended :—
Filtration plant and electric motor and switchgear (£2,360).—United Filters & Engineering Co., Ltd.

Horsham.—Urban District Council. Accepted:—
New plant for the electricity works (£12,673).—English Electric Co., Ltd.

Huntingdon.—Accepted :—
Installing electric light in Trinity Church.—Christy Bros. and Co., Ltd. (Chelmsford).

Lamp Contract.—The General Electric Co., Ltd., has received a contract for Osram lamps from the Southern Railway Co.

Leeds.—Tramways Committee. Accepted :—
Six miles trolley wire, 11¼d. per lb.—Richard Johnson and Nephew, Ltd.
Cable, schedule prices.—Union Cable Co., Ltd.
Cables.—(£1,625) W. T. Henley's Telegraph Works Co., Ltd.; (£682) Macintosh Cable Co., Ltd.; (£3,212) Enfield Cable Works, Ltd.; (£1,973) Hackbridge Cable Co., Ltd.; and (£1,576) Greenwich Cable Works, Ltd.

Liverpool.—Lighting and Tramways Committee. Supplies for 12 months :—
Stoneware troughing and insulators.—J. Place & Sons, Ltd.
Meters.—Ferranti, Ltd.
Insulated cables.—Mersey Cable Works, Ltd.; Liverpool Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.
Brass and copper castings.—Liverpool Brass and Copper Engineering Co., Ltd.; R. Roberts & Sons.
Lamp standards, brackets, &c.—T. Wilding & Son; W. Lucy & Co., Ltd.; Bowman & Beddows.
One 20-30-cwt. "Industrial" truck (£187).—Roadcraft, Ltd.; one "Little Giant" (£176); and one "Midget" (£141).—Wingrove & Rogers, Ltd. (all with Chloride batteries).

London.—Shoreditch.—Lighting Committee.
Converting plant for Evelyn Street sub-station :—
1,500-kW rotary converters :—

English Electric Co., Ltd.	£7,307
British Thomson Houston Co., Ltd.	9,080
(Alternative)	8,684
Mather & Platt, Ltd.	9,844
(Alternative)	8,889
General Electric Co., Ltd.	10,157

Mercury arc rectifiers :—

1,400 kW, Hewittic Electric Co., Ltd. (Recommended.)	9,213
1,500 kW, Hewittic Electric Co., Ltd.	9,425

The Committee is advised that as this sub-station is equipped with mercury arc rectifiers, it is desirable that the plant should be uniform throughout, and that the plant offered by the Hewittic Electric Co., Ltd., is most suitable.

Savoy Hotel, Ltd.
Cold-starting oil engine direct coupled to Crompton-Parkinson generator.—Ruston & Hornsby, Ltd.

Manchester.—Electricity Committee. Accepted :—
House wiring for lighting, &c., for 12 months.—H. Bailey, S. Dickinson, Fletcher & Thurley, Bertram Thomas, and L. E. Wilson & Co., Ltd.
Repairs to Dickinson Street lighting battery.—Tudor Accumulator Co., Ltd.
250-kVA and 500-kVA static transformers.—Hackbridge Electric Construction Co., Ltd.
750-kVA static transformers.—English Electric Co., Ltd.
Cables.—Pirelli-General Cable Works, Ltd., and British Insulated Cables, Ltd.
Cable sealing ends.—Callender's Cable & Construction Co., Ltd.
Low-pressure water valves at Barton station.—Alley and MacLellan, Ltd.
Tramways Committee. Accepted :—
Tram rail bonds.—British Insulated Cables, Ltd.
Housing Committee. Accepted :—
Electrical work, Withington housing estate.—H. Cavanagh.

Oldham.—Electricity Committee. Accepted :—
Steam piping, valves, &c., in connection with new power station.—Brightside Foundry Co., Ltd.
Oak service plugs.—Greenwood & Holden.
Meter boards.—Emmanuel Whittaker, Ltd.

Penmaenmawr.—Council. Accepted:—
Wiring 177 cottages, for the Penmaenmawr and Welsh Granite Co., Ltd.—Scott & Co. (Liverpool).

Peterborough.—Peterborough United Charities.
Installation of electric lighting and heating at the almsrooms in Cumbergate and Westgate (£190).—W. H. Prevost.

Sleaford.—Electricity Committee. Accepted :—
Testing battery for mains.—Edison Swan Electric Co., Ltd.

Wimbledon.—Electricity Committee. Accepted :—
L.p. switchgear equipments (£2,984).—George Ellison.
H.p. switchgear equipments (£2,000).—English Electric Co., Ltd.
E.h.p. switchgear, extensions to existing switchboards £1,478.—A. Reyrolle & Co.
50,000-lb. boiler with economiser chimney and induced draught plant (£16,405).—Babcock & Wilcox. (Recommended.)

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

The Barbagelata Ratiometer (believed to be Italian, London agent's name required).

Floor scraping or planing machines.

We also need the present address of Messrs. Wertheimer and White, formerly of Victoria Street, S.W.1.

Forthcoming Events.

British Electrical Development Association.—Friday, March 16th. Savoy Hotel. 2.30 p.m. Annual general meeting. 7 for 7.30 p.m. Annual dinner.

Friday, March 23rd. Royal Society of Arts. John Street, Adelphi, W.C. 7.30 p.m. "Personal Salesmanship." Mr. R. W. Brymer.

Bristol Electric Club.—Friday, March 16th. Grand Hotel, Bristol. 7.30 p.m. "Handel" and a special musical programme. Mr. F. A. Wilshire.

Royal Institution of Great Britain.—Saturdays, March 17th, and 24th. 21, Albemarle Street, W. 3 p.m. "The Transformation of Matter." Sir Ernest Rutherford.

Friday, March 16th. 9 p.m. "The Quantum and Relativity Theories of Light." Prof. E. T. Whittaker.

Association of Mining Electrical Engineers.—Saturday, March 17th. Wind Street, Swansea. Informal discussion of H.M. Inspectors' Electrical Report, 1926.

Paisley Association of Electrical Engineers.—Tuesday, March 20th. George A. Clark. Town Hall, Paisley. 7.30 p.m. "Apprentice Papers."

Society of Technical Engineers (London Branch).—Wednesday, March 21st. Engineers' Club, W. 7.45 p.m. "Current Developments in Office Organisation." Mr. N. G. Smith.

Institution of Electrical Engineers.—Thursday, March 22nd. Institution, London, W.C. 6 p.m. Electrical Research Association report on "A Critical Study of the Continuous Rating of l.p. Ordinary-duty Fusible Cut-outs." Mr. P. D. Morgan.

Informal meeting. Monday, March 19th. 7 p.m. "The Registration of Engineers." Mr. W. A. Erlebach.

(Mersey and North Wales (Liverpool) Centre).—Monday, March 19th. University, Liverpool. 7 p.m. Ordinary meeting.

(North Midland Centre).—Tuesday, March 20th. Hotel Metropole, Leeds. 7 p.m. "Higher Steam Pressures and their Application to the Steam Turbine." Messrs. A. H. Law and J. P. Chittenden.

(East Midland Sub-Centre).—Tuesday, March 20th. Technical College, Derby. 6.45 p.m. "Applications of Electricity to Medical Practice." Mr. G. G. Blake.

(Western Centre).—Monday, March 19th. South Wales Institute of Engineers, Cardiff. 6.30 p.m. "Atmospheric Electricity." Dr. G. C. Simpson.

(North-Western Centre).—Tuesday, March 20th. Engineers' Club, Manchester. 7 p.m. "Practice and Progress in Combustion of Coal as Applied to Steam Generation." Mr. F. H. Rosencrants.

(Sheffield Sub-Centre).—Wednesday, March 21st. Sheffield University. Joint meeting with kindred Societies.

(London Students' Section).—Monday, March 23rd. Institution, London, W.C. 7 p.m. "The Vacuum Tube Family." Mr. G. P. Barnard.

(North-Eastern Students' Section).—Friday, March 16th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Motor Convertors, their Design and Operation." Mr. T. A. Porteous.

Chemical Engineering Group.—Friday, March 23rd. Burlington House, W. 8 p.m. "Ultra-Violet Radiation in Industry." Mr. A. A. King.

Meter Engineers' Technical Association.—Friday, March 23rd. Lighting Service Bureau, Savoy Street, W.C. 7 p.m. Annual general meeting.

Junior Institution of Engineers.—Friday, March 23rd. 39, Victoria Street, S.W. 7.30 p.m. "H.p. and L.p. Supply for Wireless Receivers from Electric Mains." Mr. B. J. Axtens.

Birmingham Electric Club.—Friday, March 23rd. Grand Hotel. Annual dinner.

Physical Society.—Friday, March 23rd. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Notes.

Electrotechnical Conference at Leningrad.

The Pan-Union Electrotechnical Conference opened at Leningrad on Monday last and was attended by scientific workers from Moscow, the Ukraine, and other parts of the Soviet Union. A very large number of reports are to be presented. One of the first was read by Mr. Shmakov, of the Post and Telegraph Department, on the transmission of images by radio between Moscow and Berlin; the experiments began in September and the images were transmitted from Berlin on short wave-lengths (42-82 metres), and from Moscow on long wave-lengths (1,150 metres). Newspaper cuttings, portraits, and documents were transmitted, with the following results: 50 per cent. of the matter transmitted was quite legible; 12 per cent. was half legible, and 38 per cent. was a quarter legible. The imperfect transmission is explained by the low power of the Russian stations. A way out of the difficulty will probably be found in the employment of short wave-lengths not requiring great power. Experiments in this direction are being made. Professor Vologdin read a report on his "ion relay" which replaces the cumbersome oil-break switch for very powerful currents. The invention is expected to be of great importance to the two big new power stations, Svirstroi and Dnieprostroi. By means of the "ion relay" it is said to be possible to interrupt a current of up to a million kVA.—(*Reuter's Trade Service*, Moscow.)

E.A.W. Activities.

Mr. Harry Moss addressed the West Yorkshire Branch of the Electrical Association for Women at the Leeds Electricity Department Headquarters on March 8th, on "Some Things you should know about Electrical Installations." Mrs. Currer Briggs, chairman of the branch, presided.

Descendant of Michael Faraday.

The death took place at Barrowford last week of Mr. Barnabas Faraday, a descendant of the famous Michael Faraday. Deceased was 85 years of age, and had a literary and musical bent. He leaves a widow and four sons.

Appointments Vacant.

Test assistant in the Ignition and Electrical Department (92s. 7d.), for the Royal Aircraft Establishment, South Farnborough. Two shift engineers for the Hong Kong Electric Co., Ltd. Generating engineer for the London County Council Tramways Department. Assistant signal and telegraph engineer (450 Rs. per mensem), for the South Indian Railway Co., Ltd. Mains assistant (£300), for the Hazel Grove and Bramhall U.D.C. Electricity Department. Second assistant engineer (£550) for the West Midland Joint Electricity Authority. (See our advertisement pages to-day.)

A Visit to the Lighting Service Bureau.

On February 28th a visit was paid to the London Lighting Service Bureau by the members of the Illuminating Engineering Society. Mr. W. E. Bush, manager of the Bureau, delivered an address summarising some of its recent activities, in the course of which he described the improvements in the new demonstration theatre, now publicly shown for the first time. Mr. Bush also referred to the continued success of the popular Illumination Design Courses, and to the special investigations which had been recently conducted by Messrs. W. J. Jones, H. Lingard, J. L. H. Cooper, and others.

In the course of the address visitors were entertained to a full demonstration of the various ingenious devices now on show, which include a revolving electric house, demonstration shop windows, and small model rooms showing methods of domestic lighting. A very pleasing exhibit was the statue of the "lady of light," illuminated by changing coloured rays, and the small models of shops and factories, equipped with miniature lamps and designed to contrast good and bad methods of lighting, were considered particularly neat.

Mr. C. C. Paterson (chairman), in moving a vote of thanks, suggested as a possible further exhibit the floodlighting of gardens by night, of which he had recently seen some striking examples.

The Measurement of Power.

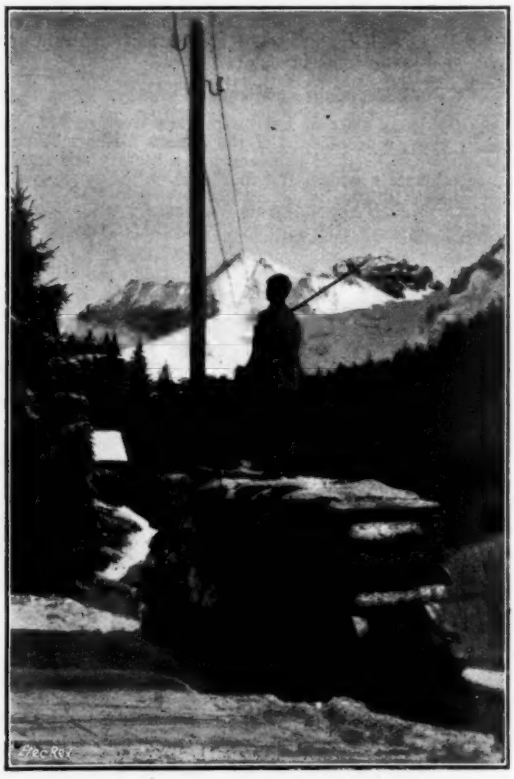
In a paper read before the North-East Coast Institution of Engineers and Shipbuilders, on March 9th, Mr. J. S. Brown, M.B.E., dealt with the subject of power measurement in connection with the work of the Marine Oil-Engine Trials Committee, and described an experimental investigation into the errors met with in the use of indicators, carried out at the Royal Technical College, Glasgow. After reviewing the history of the subject of indicator errors, the author pointed out that the errors originally disclosed in the diagrams of steam engines, where the mean pressure was, perhaps, half of the pressure range, would have much more serious consequences in an oil engine with a mean pressure of only one-fifth of the maximum pressure. The various components of an indicator outfit were individually examined and tested, and the results were exhibited in the form of graphs. It was shown that the "mechanism factor" in general increased directly with the speed, the height of the diagram, and the reduction in area of the indicator piston, and could be expressed in lb./sq. in. mean pressure in terms of these quantities. The errors due to the cord and to the indicator pipe could also be ascertained in terms of mean indicated pressure by suitable formulæ, given in the paper. The author concluded that by the use of the expressions which he deduced, the more prominent errors could be evaluated, and could be used as corrections for diagrams taken in the ordinary way. Such corrections could only be approximate, but their use would rationalise the comparison of the performances of different engines. Actual examples showed that the necessary aggregate correction might amount to about 5 per cent. of the mean pressure shown by the cards, and this correction might be positive or negative, depending on the speed of the engine.

International Illumination Congress.

An International Congress on Illumination, which is to be held in the United States this year, and will open on September 7th with a tour by the foreign delegates to various American cities, will include the twenty-second Annual Convention of the Illuminating Engineering Society at Toronto (September 17th-20th), and close with the eighth session of the International Commission on Illumination to be held at Saranac Inn, New York (September 22nd to 28th). The arrangements are being made under the auspices of the Illuminating Engineering Society and the U.S. National Committee of the International Commission on Illumination.

Carrying Ideas to Newcastle.

The picture herewith is a reproduction of a snapshot taken by Mr. C. R. Belling. It shows Mr. W. F. T. Pi the Newcastle-upon-Tyne Electric Supply Co., Ltd., examining an overhead transmission (!) line in Switzerland some



Mr. Pinkney (Newcastle) in Switzerland.

7,000 ft. above sea level. Even with due regard to the cheapness of overhead transmission on the Continent, we cannot accept Mr. Belling's suggestion that the line might have been built for 66,000 V.

Large Diesel-Electric Oil Tanker.

The oil-carrying vessel *Brunswick*, which was launched on March 7th by Messrs. Scott's Shipbuilding and Engineering Co., Ltd., Greenock, for the Atlantic Refining Company, of Philadelphia, U.S.A., is claimed to be the first oil tanker built in the United Kingdom for propulsion by Diesel-electric machinery, and the largest ship to be fitted with Diesel engines. The propelling machinery consists of four single-acting Carels-Ingersoll-Rand solid-fuel-injection Diesel engines, each coupled direct at the aft end to one 600-kW, 250-V main and one auxiliary electric generator. The main generators run in series and so supply current at 1,000 volts to the main propelling motor. This is of the double-armature type, and is designed for transmitting about 2,800 s.h.p. at 95 r.p.m. to the propeller. The whole of the switchgear is arranged in a room extending across the centre of the ship for about 30 feet at the level of the main deck, and conveniently placed in relation to the main generators and the main propelling motors. All the motor controls are situated within this room, but each motor is push-button operated on site, except the main propelling motor; this is controlled from the bridge and puts the navigation of the vessel entirely in the hands of the deck officers. The electric drive lends itself readily to this method of control. The whole of the electrical installation, including the motors for the auxiliaries, has been supplied by the British Thomson-Houston Co., Ltd., of Rugby.

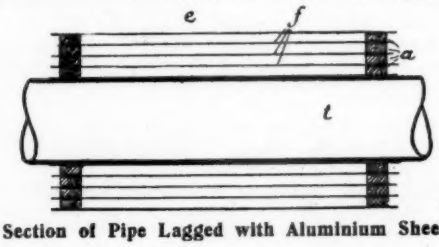
All the auxiliaries are electrically driven, including three cargo-oil pumps, which are served by 80-h.p. motors placed in the engine room, the pumps being in a separate room on the forward side of the engine room bulkhead. There will be also installed in the engine room a small waste-heat boiler, working at a pressure of 25 lb. per sq. in., for providing steam for heating the officers' and crews' quarters and other compartments. This boiler is equipped with independent oil-burning plant, but it is designed for utilising the heat in the exhaust gases from two of the main engines when these are in service at sea. The steering gear is of the electro-hydraulic type, manufactured by Messrs. John Hastie & Co., Ltd., and there will be a gyro-pilot outfit for automatic steering. The whole of the machinery has been designed to the requirements of Mr. Lester M. Goldsmith, consulting engineer, and Lloyd's Register of Shipping.

Arc Welding for Buildings.

The use of arc welding for building construction has been proved to be not only entirely safe, but also cheaper than riveting. According to Mr. G. D. Fish, consulting structural engineer of the Westinghouse Company, U.S.A., tests prove that arc-welded joints can be made stronger in every way than the members joined, and that arc-welded girders can be made to resist greater stresses than riveted girders of the same dimensions and weight. A number of arc-welded buildings have been erected, and tests made on the completed structures have shown that the strength of the joints conforms accurately to calculations. There is a reduction in the tonnage of steel required, and a saving per ton in the cost of the steel handled. Tonnage is saved by the use of lighter members and the elimination of much connecting material. For example, a five-storey arc-welded building contains 12 per cent. less steel than would a similar riveted building. In a welded railroad bridge now under construction at Chicopee Falls, Mass., the amount of steel being used is 33 per cent. less than that needed for riveted construction. Savings in the cost of handling are due to the fact that a very large proportion of the punching, fabrication, and detailing essential for riveting is not needed with arc welding. In an arc-welded building erected at Derry, Pa., 60 per cent. of the steel was not fabricated, and the cost of the structure was 12 per cent. below the cost if riveted. There is nothing dangerous about welding if proper control is exercised; the only danger is that which is inherent in any new method—the lack of experience on the part of those using it. The steps necessary to ensure control are correct engineering, the schooling of welding operators, and inspection by men trained in that work. Mr. Fish states that as design economy becomes better understood, as shop arrangement and equipment become adapted to welded fabrication, as labour becomes more efficient in handling the methods, and as high-speed automatic welding reduces welding cost, the relation of cost between welded structures and riveted ones will vary rapidly in favour of welding.

Aluminium Sheet Lagging.

A German engineer, named Schmidt, has experimented with concentric sheets of aluminium foil for lagging hot pipes, instead of the usual insulating materials. As shown in section in the accompanying figure, reproduced from *Le Génie Civil*, the sheets *f* are lapped round distance-pieces *a*, and are surrounded by a stout enclosure *e*. The heat is retained by the layers of air entrapped between the sheets. It is stated that this form of lagging weighs only one-tenth or one-twentieth as much as the customary types, a great advantage in that there is practically no loss of heat by storage in the



Section of Pipe Lagged with Aluminium Sheet.

lagging in the case of intermittent use. Aluminium resists corrosion, heat, damp, and vibration, and it is claimed that the system is more efficient and no more costly than other methods of heat insulation.

A New Electric Hammer.

Aktiebolaget Nordiska Armaturfabrikerna will shortly put on the market an electric hammer invented by Professor W. Weibull, called the Weinaf hammer. It consists of an electric motor and mechanical striking apparatus, with a striking power of several hundredweight. The hammer will be manufactured at works belonging to the Armaturfabrikerna concern for sale in Sweden and the neighbouring countries, and affiliated companies will be formed for its manufacture in great industrial foreign countries. The hammer is expected to supplant pneumatic tools to a large extent. At present it is manufactured in three sizes, with total weights of 1½, 6, and 15 kilograms respectively.—*Reuter.*

Association of Mining Electrical Engineers.

The South Wales Branch of the Association of Mining Electrical Engineers held its annual dinner at Cardiff on Saturday last, Major E. Ivor David, M.I.E.E., presiding. Replying to the toast of "The Association," submitted by the High Sheriff of Glamorganshire, Mr. D. G. Hall, the chairman, said the

application of electricity in the South Wales district was more highly developed, and there was more electrical energy used per ton of coal mined than anywhere else in the Kingdom. Electrical machines of over 400,000 h.p. were installed, *i.e.*, 25 per cent. of the total for the whole country, but out of four fatal accidents in the latest report of H.M. Inspector, not one had occurred in that district. The standard of the mining electrical engineer was very high, and that was the largest branch of the Association, and could claim the highest number of awards for papers and examinations. Unfortunately, the standard of wages was not commensurate with the other standards; there were many colliery electricians in South Wales on the subsistence wage. The colliery electrician had a twelve-hour day and a seven-day week; overtime was a normal affair to him. The efficiency of his plant was his great concern, and as a result he had no leisure to be continually bothering about increases of pay. The present methods of engaging colliery electricians were haphazard; they felt that the A.M.E.E. certificate should be the standard, and a colliery manager should make its possession the first qualification of an applicant. If this were done the Association would see that the standard of its examinations, at present high, would be maintained.

Replying to the toast of "Our Guests," Capt. J. M. Carey, Divisional Inspector of Mines, referred to the small number of fatal accidents from electrical causes, and said that those which had occurred were of a nature that no legislation could prevent. This spoke volumes for the efficiency of the electrical engineer and for the way in which he maintained his plant.

During the evening Mr. Idris Jones, on behalf of the electrical staff of the Powell Duffryn Steam Coal Co., Ltd., presented Major E. Ivor David with a silver tray as a token of their appreciation and respect.

Association of Supervising Electrical Engineers.

The Board of Control announces the opening of the sixth annual competition for the W.E. Highfield Shield. In addition to the Shield, five prizes will be offered, three to members and two to associates, their value ranging from £1 1s. to £4 4s. All papers, addressed to the general secretary, must reach head office not later than Monday, April 23rd, 1928. The decision of the Examining Board will be published in the May issue of *Contact*, and the prizes and certificates will be presented at the opening meeting in October next.

Institution Notes.

Institution of Electrical Engineers.

SUMMER MEETING.—Following upon the decision not to proceed with the proposed Summer Meeting in Norway, the Council of the Institution has received and accepted an invitation from the Committee of the Scottish Centre to hold the meeting in Scotland, from June 26th to 29th, 1928, inclusive. Visitors will assemble in Glasgow on Monday, June 25th, the proceedings commencing on the following morning. The programme will include one day each in Glasgow and Edinburgh, and an excursion into the Western Highlands, including a visit to Lochaber. The meeting will break up at Oban on the morning of June 30th. Members of the Institution will receive further particulars shortly.

Royal Institution.

The Friday evening discourse on March 30th will be delivered by Sir Ernest Rutherford, on "Radioactive Atoms and their Structure."

Junior Institution of Engineers.

The many uses to which compressed air is now put were mentioned by Mr. E. S. Huntingford in a lecture before the Institution on March 9th, on the subject of "Air Compressors." He said that there were more air compressors of 200-300 cu. ft. capacity than of any other size, and nearly all of these were single-stage machines, generally of the vertical single-acting type. The proper method of rating compressors was by reference to free air capacity. A well-designed compressor would have an efficiency of 75 to 80 per cent.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review posted concerning their movements.

Mr. P. J. ROBINSON, whose portrait appears herewith, has been appointed by the Liverpool City Council as successor to the late Mr. H. Dickinson in the post of city electrical engineer,

J. Bacon & Sons [*Liverpool.*

Mr. P. J. Robinson,

who has been appointed City Electrical Engineer of Liverpool.

at a salary of £1,800 per annum. Since Mr. Dickinson's death he has been carrying out the duties of the post. Mr. Robinson was born in 1879. He was apprenticed to Messrs. Johnson and Phillips, Ltd., and was for two years at the Finsbury Technical College under Professor Silvanus P. Thompson. He holds the City and Guilds of London Diploma for electrical and mechanical engineering and chemistry. He was engaged for a short period in Professor Thompson's private laboratory, and, later, obtained a position with the British Insulated & Helsby Cables, Ltd. After sixteen months with this company he became engineer and manager to the Garston & District Electric Supply and Tramways Company (a subsidiary of the B.I. Company), and was responsible for the design and lay-out of the Garston district generating station, and the laying of the tramways between Aigburth Vale and Garston terminus. When the undertaking was purchased by the Liverpool Corporation in 1902, Mr. Robinson was appointed an assistant engineer in charge of the Pumpfields generating station. In 1905, he became mains engineer and was responsible for the whole of the laying of the underground mains in the city. About three years later he was appointed superintending engineer of stations, and carried out these duties for a period of nine years. He was given the position of chief engineering assistant to the city electrical engineer in 1917, and from 1920 up to the present time he has carried out the duties of deputy electrical engineer. Mr. Robinson is a member of the Institution of Electrical Engineers, and a member of the Council. He is immediate past-chairman of the Mersey and North Wales Centre of the Institution. He is also an associate member of the Institution of Mechanical Engineers, and honorary life member of the Society of Civil Engineers of France.

The *Railway Gazette* states that Mr. JOHN WILSON, O.B.E., M.I.E.E., who has been appointed chief electrical engineer to the Buenos Aires Western Railway, was appointed in January, 1914, as electrical engineer to the Buenos Aires Western Railway, to take charge of their complete electrification scheme, the contracts for various sections of which had just been placed. On arrival in the Argentine in May, 1914, he was placed in charge of the construction work. Owing to the war the work was considerably delayed through the non-receipt of plant, &c., and was finally practically suspended in July, 1917, when Mr Wilson returned to England as a volunteer. He obtained a captaincy in the Royal Engineers (I.W. & D.), and for nine months was engaged on electrical duties at the War Office He returned to Buenos Aires in May, 1919, when the elec-

trification construction works on the Western Railway were resumed, the complete service being inaugurated in May, 1923. Since that date, says our contemporary, Mr. Wilson has been responsible for the successful operation of the B.A.W.R. electrification scheme, as well as for the electrical installations for power and lighting throughout the line.

According to a statement published in the *Electric Railway and Tramway Journal*, a Special Committee of the Belfast Town Council has issued a report recommending the termination of Mr. CARLISLE's engagement as general manager of the tramways; that in view of the magnitude of the undertaking, special conditions and qualifications relating to the appointment of a new general manager of extensive administrative experience and engineering qualifications be drawn up; and that Mr. Carlisle be offered another post in the undertaking.

Mr. H. S. WHITELEY, chief engineer for the last 14 years to the printing firm of Messrs. Spottiswoode, Ballantyne and Co., Ltd., has relinquished that position to join the firm of Messrs. Dawson, Payne & Lockett, Ltd., Dean Street, Fetter Lane, E.C.4, printers' engineers and electricians. Mr. Whiteley is particularly experienced in two-revolution presses and the electrical driving of printing machinery. He has been a member of the Diesel Engine Users' Association from its commencement.

Mr. R. WEAVING, M.I.E.E., late transformer superintendent for the English Electric Company, has now joined the staff of Crompton-Parkinson, Ltd., and will take charge of the transformer shops at Chelmsford.

The Malvern Urban Council has increased the salary of Mr. E. D. WOOTTEN, gas and electrical engineer, from £600 to £700 per annum.

The East Ham Town Council has appointed Mr. H. J. WIDGERY as outdoor representative for the electricity undertaking.

Sheffield City Council Watch Committee recommends that the salary of Mr. J. F. COLQUHOUN, lighting engineer, be increased from £500 to £600 per annum.

The manager and staff of the Urban Electric Supply Co. at Glossop have presented an inscribed gold watch to Mr. FRANCIS MCCARDELL, who is leaving the staff after 22 years' service.

The Tilbury Urban Council has appointed Miss ANNIE HAYES as attendant at the electrical showroom, from among 34 applicants.

Mr. THEODORE STRETTON, M.I.E.E., M.I.Mech.E. (Haslam and Stretton, Ltd.), Cardiff, was at the last meeting of the Council of the Electrical Wholesalers' Federation elected president and chairman for the ensuing year.

Obituary.—MR. J. P. HOOPER.—We learn with deep regret of the death, which occurred on Monday last, of Mr. John Pitman Hooper, M.I.E.E., chairman of Hooper's Telegraph and India-rubber Works, Ltd., in his 81st year. Mr. Hooper passed away at Deepdene, Streatham Common, of heart failure following an operation. We shall refer fully to his life and career in our next issue, but here we desire to place on record our feelings of deep sympathy for his widow. The funeral service takes place at Immanuel Church, Streatham Common, at 2.30 p.m. to-day (Friday), the interment following at 3.15 p.m. at St. Nicholas' Parish Church, Tooting.

Wills.—Mr. R. MAUDE, for many years chairman of the Campbell Gas Engine Co., Ltd., left £24,986 gross and £23,561 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Robinson & Hands Electric Co., Ltd.—Private company. Registered March 6th. Capital, £5,000 in £1 shares (4,980 7 per cent. cumulative preferred and 20 ordinary). Objects: To acquire the business formerly carried on by Robinson and Hands Electrical Co., Ltd., in so far as it consists of electrical and wireless factors and all trade marks, patents and designs connected therewith, the leases and tenancies vested in the company of and in 54, 55 and 56, Barwick Street, Birmingham, 2, Broadgate, Lincoln, Glebe Street, Stoke-on-Trent, and 47, Station Road, Taunton, together with all factoring stocks, &c., and to adopt an agreement with G. W. Sparrow and F. E. Bendall. The first directors are:—A. C. Robinson, 100, Jockey Road, Sutton Coldfield, electrical engineer (chairman); F. H. Fennell, 16, Salisbury Road, Moseley, Birmingham, secretary (life directors). Secretary: F. H. Fennell. Registered office: 54, Barwick Street, Birmingham.

W. P. Barnell & Co., Ltd.—Private company. Registered March 6th. Capital, £2,500 in £1 shares. Objects: To carry on the business of electricians and mechanical and wireless engineers, &c. The permanent directors are:—W. P. Barnell, 23, Linden Road, Northampton; J. V. Hutchings, 46, Boughton Green Road, Northampton; E. H. Cunnington, 89, Talbot Road, Northampton. Qualification, £100 shares. Secretary: E. H. Cunnington. Registered office: County Chambers, 1, The Drapery, Northampton.

Bromley-Langton Electric Wire and Insulator Co., Ltd.—Private company. Registered March 8th. Capital, £2,000 in £1 shares. Objects: To acquire the business of manufacturers' agents, dealers in bare and insulated wires and cables, rubber and insulating materials, and electrical and radio accessories, carried on by H. T. Bromley and F. C. Langton as Bromley and Langton, at 29, Newman Street, W. The first directors are:—H. T. Bromley, 32, Long Lane, Croydon, merchant; F. C. Langton, 13, Gowan Road, Willesden Green, merchant (both permanent). Secretary: F. C. Langton. Registered office: 29, Newman Street, W.1.

National Accumulator Co., Ltd.—Registered as a "public" company on March 9th, with a nominal capital of £350,000 in £1 shares (175,000 5 per cent. cumulative preferred ordinary and 175,000 deferred ordinary). The objects are to acquire a share controlling interest in the D.P. Battery Co., Ltd., and the Hart Accumulator Co., Ltd., to manufacture and deal in cables, wires, lines, connections, lamps, dynamos, generators and accumulators, to carry on the business of electricians, electrical and mechanical engineers, &c. The minimum cash subscription is £7. The first directors (to number not fewer than three or more than six) are:—B. M. Drake, "Copyhold," Cuckfield, electrical engineer; W. C. Johnson, Broadstone Place, Colemans Hatch, Sussex, engineer; Sir John Prestige, Bourne Park, Kent, electrical engineer; H. W. Lee, "Westwood," Oaklands Road, Bromley, engineer. Qualification, after December 31st, 1928, £100. Registered office: 36, Grosvenor Gardens, S.W.1.

Jelco Trading Co., Ltd.—Private company. Registered March 3rd. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in electrical and wireless lamps, valves, wires, cables, apparatus, &c. The subscribers (each with one share) are:—S. van Mindeno, 159, Keizersgracht, Amsterdam, merchant; H. Weinberger, 20, Hampstead Road, N.W., merchant. S. van Mindeno is the first director. Registered office: 2, Dyers Buildings, Holborn, E.C.1.

Trent Valley and High Peak Electricity Co., Ltd.—Public company. Registered March 5th, with a nominal capital of £20,000 in £1 shares. The objects are to carry on business as indicated by the title. The minimum cash subscription is 7 shares. The subscribers are: W. H. Walford, 10, Lambourne Road, Leytonstone, E.11, solicitor's clerk; W. J. Yeoman, 244, Lordship Lane, East Dulwich, S.E.22, solicitor's clerk; and five others. Registered office: 25, Victoria Street, Westminster, S.W.1.

Newling Electric Supplies, Ltd. — Private company. Registered March 1st. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in electric lamps and all kinds of electrical goods and equipment, &c. The directors are:—C. G. Newling (permanent governing director and chairman), 20, Princes Street, Hanover Square, W.1; C. S. C. Rippon, 10L, Oxford and Cambridge Mansions, N.W.1. Qualification of governing director, 1,000 shares; of ordinary directors, 50 shares. Secretary: J. Dyer. Registered office: 5, Princes Street, Hanover Square, W.1.

Truphonic Trading Co., Ltd.—Private company. Registered March 5th. Capital, £6,000 in 5,000 participating cumulative 10 per cent. preference shares of £1 each and 20,000 ordinary shares of 1s. each. Objects: To adopt an agreement with F. W. Welstead and F. M. Cooper, and to carry on the business of manufacturers of and dealers in wireless sets, wireless cabinets, loud speakers, valves, batteries and accumulators, gramophones, &c. The subscribers are: G. J. Armstrong, 24, Bedford Row, W.C.1, solicitor, 95 ordinary shares; E. F. A. Day, 24, Bedford Row, W.C.1, solicitor's clerk, 5 ordinary shares. Registered office: 189, Regent Street, W.1.

Official Returns of Electrical Companies.

Fry & Co., Ltd.—Debenture dated February 6th, 1928, to secure £2,200, charged on the company's property, including uncalled capital. Holder: Dr. S. T. Lord, "Leckthwaite," Sudden, Rochdale.

Pontypool Electric Light and Power Co., Ltd.—Issue on February 17th, 1928, of £600 debentures, part of a series already registered.

Hendon Electric Supply Co., Ltd.—Trust deed dated February 23rd, 1928, to secure £200,000 debenture stock charged on the company's undertaking and property, present and future, including uncalled capital. Trustees: Beaver Trust, Ltd., 1, Queen Victoria Street, E.C.4.

Rangoon Electric Tramway and Supply Co., Ltd.—Satisfaction to the extent of £300 on June 28th, 1927, and to the extent of £3,200 on November 7th, 1927, of debenture stock dated February 1st, 1906, to January 25th, 1924, securing £250,000. (Notice filed February 28th, 1928.)

Allen West & Co., Ltd.—Debenture dated February 21st, 1928, to secure £40,000, charged on the company's property and assets, present and future, including uncalled capital. Holders: Bishopsgate Nominees, Ltd., 15, Bishopsgate, E.C.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £11,800 on various dates between May 17th, 1927, and February 13th, 1928, of debentures secured by trust deeds dated October 6th, 1913, and December 31st, 1918, securing £250,000 and a premium of 3 per cent.

Radio Service (London), Ltd.—Satisfaction in full on February 15th, 1928, of debenture dated July 25th, 1927, securing £125.

Malay and Eastern Power Development Co., Ltd.—Mortgage created outside the United Kingdom dated January 11th, 1928, to secure 57,275 dollars, charged on certain land in the district of Kinta, Perak. Holders: Chartered Bank of India, Australia and China, Ipoh, Federated Malay States.

Kinetic Elutriators, Ltd.—Capital, £5,500 in 5,000 preference shares of £1 each and 10,000 ordinary shares of 1s. each. Return dated December 31st, 1927. 2,700 preferred and 10,000 ordinary shares taken up. £2,800 paid on 2,700 preference and 2,000 ordinary shares. £400 considered as paid on 8,000 ordinary shares. Mortgages and charges nil.

H. W. Dutton & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1927. All shares taken up. £1,756 5s. paid (£1 per share on 50 and 17s. 6d. per share on 1,950 shares). Mortgages and charges nil.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.—Capital, £1,250,000 in £1 shares. Return dated December 8th, 1927. 1,000 000 shares taken up. £1,000,000 paid. Mortgages and charges, £400,000.

Cymbal, Ltd.—Satisfaction in full on November 30th, 1927, of debenture dated May 4th, 1926, securing all moneys due or to become due. (Notice filed February 27th, 1928.)

Industrial Engineering, Ltd. (formerly Brilliant Arc Lamp and Engineering Co., Ltd.).—Trust deed dated February 18th, 1928, to secure debenture stock for £5,383 16s. 7d., charged on the company's undertaking and assets, including any uncalled capital. Trustees: S. G. Kelsey, 23, North Gate, Regent's Park, N.W.; and A. E. Macey, 34, Braemore Road, Seven Kings.

Moss Gear Co., Ltd.—Satisfaction to the extent of £3,000 on January 3rd, 1924, of debentures dated December 29th, 1917, securing £25,000. (Notice filed February 24th, 1928.)

City Notes.

Electrical Distribution of Yorkshire, Ltd.

Mr. R. W. Wickham (chairman), speaking at the annual meeting on March 6th, said that the addition of 6,695 new consumers during the year was the largest number of connections made in any year since the formation of the company. They had taken over on mutually satisfactory terms two non-statutory undertakings, New Sharlston and Great and Little Houghton. The number of housing estates which they served continued to grow. Included in these schemes was the large estate adjacent to the Thorne Collieries, upon which over 1,000 houses had already been built. The company was meeting in rural districts the demands of dwelling houses, shops, and many other classes of property, and was also making a large number of agreements with local authorities for street lighting. Further reductions of prices were being made from April next in two of the company's tariffs. During 1927 the company was authorised to supply electricity under the Ardsley, Methley and District Electricity Special Order, which enabled a supply to be given in the urban districts of Altofts, Ardsley East and West, and Methley, as well as in the rural district of Wakefield, and part of the rural district of Tadcaster. The Electricity Commissioners had since made further Orders for an additional part of the rural district of Tadcaster and for a substantial portion of the rural district of Skipton. The issue of capital made last March was a great success. It was not intended to make an issue of new shares this year, as arrangements had been made whereby the company could carry on for the present. Later in the year shareholders would be asked to authorise the increase of the present capital.

Midland Counties Electric Supply Co., Ltd.

The annual meeting of this company, whose report was reviewed in our issue of March 2nd, p. 385, was held on March 5th. Mr. G. Balfour (chairman), who presided, said that the electrical energy sold amounted to 104,537,000 kWh, an increase of 30,972,000 kWh as compared with 1926. The connected load had increased by 17,900 kW to 85,620 kW, and the maximum supply demanded was 37,760 kW. In three years the number of consumers connected had been doubled, and the sales of electricity and the load connected had been nearly doubled. During the year 98 miles of e.h.p. lines and 107 miles of l.p. lines had been provided, increasing the totals to 523 and 354 respectively. A supply had been connected in 33 parishes and urban districts, while a bulk supply to Long Eaton Urban District Council had been commenced. The average price received from the sales of electricity by the Derbyshire and Nottinghamshire Electric Power Co. was 0.88d. per kWh, and for the Leicestershire and Warwickshire Electric Power Co., 1.258d. per kWh, or an average of 1.05d. per kWh. To meet the growing demand a 15,000-kW turbo-alternator, with auxiliaries and boilers, had been installed at Spondon power station, and orders had been placed for a 25,000-kW set and additional boilers. No additional plant had been installed during 1927 at the Avon or Hinckley stations, but application had been made for an extension comprising a 12,500-kW turbo-alternator, &c., at the Avon station. The report and accounts were adopted, and at a subsequent meeting a resolution was passed increasing the authorised capital from £3,000,000, to £4,000,000.

London Electric Supply Corporation, Ltd.

The annual meeting of this company was held on March 6th. In presenting the report and accounts (*vide* our issue of March 2nd, p. 386), Mr. R. H. Benson (chairman) said that the demands for lighting and power purposes continued to increase, and with regard to traction, preparations were being made for an increased supply to the Southern Railway during this year. The cost of production was reduced from 0.779d. per kWh sold in 1926 to 0.655d. in 1927, a reduction of over 15 per cent. It had been decided to sell the Deptford power station outright to the London Power Co., Ltd., instead of leasing it. The electricity supply industry was suffering from the extraordinary burden of rates, and the total sum paid by the company during 1927 amounted to £85,792, or more than 41 per cent. of the total fuel costs. Since the scheme for the interconnection of the main power stations had been introduced, the company's anticipations with regard to the advantages to be derived by consequent increased efficiency and security of supply had been amply justified. This was particularly in evidence during the recent Thames floods, when one of the main power stations was entirely shut down and the whole of the supply for the particular area was given by the other interconnected stations. Adequate provision had been made by the London Power Co., to supply the future demands of the company. The report and accounts were adopted.

Charing Cross Electricity Supply Co., Ltd.

In his speech at last week's annual meeting, the chairman (Mr. W. F. Fladgate) referred to the satisfactory results during 1927, and said that after paying the standard dividend there was a substantial surplus, and in view of that the company had decided to make a material reduction in charges at once. He reminded shareholders that the company was now purchasing its electricity from the London Power Co., but said that the expenditure on distribution would be considerable during the next few years. They were arranging to deal with a 100 per cent. increase during the next ten years; they were doing this by the erection of automatic sub-stations in various parts of the area. The first (1,500 kW) was already running at Soho Square. During the current year a 3,000-kW substation was being erected in Aldwych; they hoped to have it running by August. This station would not only be automatic, but would also be controlled from the Shorts Garden station. A new 1,200-kW Diesel set was started up in the latter station in November, the largest yet manufactured for land purposes,

and another similar set was being erected in the St. Martin's Lane station in time for next winter's load. The report and accounts were adopted. In moving the re-election of Mr. Fladgate as chairman, Mr. J. M. Gatti paid him a high tribute for the valuable work which he had done for the company and London's electricity supply. Later, the company's scheme for the institution of a superannuation scheme for the employés was approved.

Underground Electric Railways Co. of London, Ltd.

Lord Ashfield (chairman and managing director) presided at the annual meeting held on March 7th, and in presenting the report and accounts (*vide* our last issue, p. 432) said that the operations of the combined companies for 1927 constituted a record, the number of passengers carried being 1,669 millions, an increase of 7 per cent. over 1926. He drew attention to the successful operations of the Associated Equipment Co., which had paid a dividend of 8 per cent. free of tax, and of the North Metropolitan Electric Power Supply Co., which had again paid a dividend of 10 per cent. upon its ordinary shares. Lord Ashfield referred to the proposals for a common fund and a common management of the local passenger transport undertakings within the London traffic area as proposed by the London and Home Counties Traffic Advisory Committee. The company was already committed to a wide measure of co-ordination for the transport undertakings, without which London would not have obtained the liberal and progressive transport facilities which it now enjoyed. The past record of the company also committed it to the support of the ampler proposals now brought forward. The aim must always be to secure adequate service at reasonably low fares, and this aim presupposed co-ordination among those who provided the service. The report and accounts were adopted.

City of London Electric Lighting Co., Ltd.

The report for 1927 states that the L.C.C. has at last signified its approval of the sum of £705,214 as representing the total costs and charges to be allowed in computing the standard prices for the purposes of the sliding scale under the London Electricity (No. 1) Act, 1925. The sub-division of the amount over the four separate classes of supply has still to be determined. Therefore, after the payment of the standard dividends for the year, the balance of net revenue is left in suspense. This balance amounts to £47,652, and, with the surplus brought forward, a total of £70,194 remains in suspense. The agreement with the L.C.C. has enabled the company to reduce its charges as from the March quarter meter readings. The report refers to the work of the Central Electricity Board, and states that the directors have assured the Board of the company's support. The majority of the holders of the £400,000 second debenture stock have accepted an offer for the conversion of their holdings into consolidated debenture stock at the rate of £95 of the consolidated stock for £100 of the second debenture stock; this has reduced redemption liabilities by £17,561. Meeting: March 21st.

British Insulated Cables, Ltd.

The report of the directors for the year ended December 31st last records a profit of £609,242, as compared with £607,853 for 1926. To this is added £271,721 brought forward, making available £880,963. The allocations include debenture interest, directors' fees, and remuneration to works committee £5,770, and after paying the preference and interim ordinary dividends there remains £439,214. Of this, £100,000 is put to depreciation on buildings, plant, machinery, &c., and £200,000 is transferred to reserve. It is proposed to pay a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year (as in 1926), leaving £305,880 to be carried forward. The directors regard the result of the year's working as satisfactory. The report refers to the death of the chairman of the company, Mr. James Taylor, and expresses appreciation of the long and valuable services which he rendered to the company. Mr. John Ferguson has been elected a director. Meeting: Liverpool, March 20th.

Liverpool Overhead Railway Co.

The report for 1927 states that the gross revenue was £93,558, and the expenditure, including appropriations to reserve, £83,200. After meeting debenture interest there is a surplus of £3,603, which is placed against a debit of £3,069 brought forward, leaving a surplus of £534. The number of passengers carried rose from 7,006,230 to 7,328,176. Arrangements have been made for taking a supply of electricity from the Liverpool Corporation, and the company's generating station was shut down in June last. At last Wednesday's meeting a shareholder was to move a resolution providing for the reduction of the directors' remuneration from £800 to £400 per annum.

Bristol Tramways and Carriage Co., Ltd.

The report for the year ended December 31st, 1927, records a revenue of £1,096,521 gross and £111,285 net (including the balance brought forward). After the usual appropriations, a final dividend of 4 per cent. is recommended on the ordinary shares (making 7 per cent. for the year), £10,000 is transferred to contingencies and renewals reserve, and £5,915 is carried forward. Although the total revenue increased, there was a decline of £246 in the tramway department. The total number of passengers carried rose from 104,886,393 to 107,634,308. The meeting was to be held yesterday (Thursday).

Imperial Tramways Co., Ltd.

The accounts for the year ended December 31st last show an available balance of £14,469, after meeting debenture interest and interim preference dividend. The reserve for depreciation and contingencies receives £8,275, the balance of the preference dividend is paid, and £1,395 is carried forward. The report states that a dividend of 7 per cent. was received upon the company's holding of ordinary shares in the Bristol Tramways and Carriage Co., Ltd., but although the revenue of the London and Suburban Traction Co., Ltd., improved, no dividends were paid.

Waygood-Otis, Ltd.

The net profit for the past year fell from £88,772 to £68,115, but the ordinary dividend is maintained at 10 per cent. (2½ per cent. already paid) and in addition a bonus of 10 per cent. is being distributed. Certain special reserves, being no longer required for the purposes for which they were created, have been merged in the contingencies reserve, raising it from £143,165 to £200,078. A balance of £12,315 is carried forward. The directors have accepted an advantageous offer for the company's goodwill in certain non-British territory. The meeting was held yesterday (Thursday).

American Telephone and Telegraph Co.

The balance sheet as at December 31st last shows a surplus of assets of $272,435,982. The total income for the past year was $216,524,824, and the net income was $128,614,910, of which dividends absorbed $97,379,934. The total carried to surplus was $79,173,841.

The Bell System accounts for the year show total operating revenues of $894,699,173, and a net income of $166,059,152. Dividends absorbed $112,401,125, and $101,596,892 was carried to surplus.

Mackay Companies.

The report for 1927 shows a total income of $4,910,835 and a balance of $4,627,417. This, with the surplus brought in, makes $6,787,819 available. Dividends paid on the Mackay Companies' shares absorb $4,611,989, leaving a surplus of $2,175,830. The investments appear in the balance sheet at $93,404,578, and the issued capital is $91,380,400.

Llandudno and Colwyn Bay Electric Railway Co., Ltd.

After meeting operating and administrative expenses and debenture charges there was a surplus of £332 on the 1927 accounts. This is placed against the debit balance brought forward, reducing it to £733. The report states that traffic receipts were lower on account of the bad weather and motor-'bus competition.

Radio Corporation of America.

This company reports a gross income of $65,082,074 for 1927, against $60,835,747 in 1926. The total net income was $11,799,650, against $7,396,487. No dividend is paid on the common stock, but the preferred dividend is paid, $4,500,000 is placed to reserve, and about $1,800,000 is written off patents and machinery.

Pennsylvania Water and Power Co.

After provision for operating expenses, fixed charges, &c., there was a surplus of $1,553,353 for 1927. Two dividends of 2 per cent. and two of 62½ cents have been paid, $300,000 has been transferred to sinking fund and reserve and a balance of $23,052 is carried to surplus.

Stewarts & Lloyds, Ltd.

The profit for 1927 was £615,000. From this the usual preference and preferred dividends are paid; the dividend on the deferred shares is 1s. per share (against 6d. in 1926); £175,000 is transferred to reserve and £114,000 is carried forward.

Pinchin, Johnson, Ltd.

The net profit for 1927 rose from £148,339 to £358,513. The dividend is maintained at 30 per cent. An issue of ordinary shares to existing shareholders is to be made in the proportion of one new share for each four held. The issue price will be £2, *i.e.*, £1 premium.

Automatic Telephone Manufacturing Co., Ltd.

The profit for the year ended December 31st last was £171,359 (against £161,497 in 1926). A final dividend of 6½ per cent. is being paid on the ordinary shares, making 10 per cent. for the year, as for 1926. The amount carried forward is £81,755.

International Automatic Telephone Co., Ltd.

The accounts for 1927 show a profit of £124,369, as compared with £119,884 for 1926. The dividend on the deferred shares is unchanged at 10 per cent. and the amount carried forward rises from £38,583 to £59,592.

Midland Electric Corporation for Power Distribution.

A final dividend of 2s. per share (making 15 per cent. for the year) is recommended on the ordinary shares. The directors propose to distribute a 100 per cent. bonus to ordinary shareholders, capitalising part of the reserves.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Stock Exchange Committee under Rule 159 :—

Hydro-Electric Securities Corporation.—420,838 shares of common stock of no par value (in certificates of 10 shares each.

Application has been made to the Exchange Committee to allow the following to be officially quoted :—

County of London Electric Supply Company.—£4,250,000 5 per cent. debenture stock.

Companies to be Struck off the Register.

The names of the undermentioned companies will be struck off the register at the expiration of three months, and they will be thereby dissolved :—

Fleet Electric Co., Ltd.

New British Electric Supply Co., Ltd.

Commonwealth Edison Co.

This American company reports operating revenue of $71,628,560 for 1927, an increase of nearly $6,000,000. The operating expenses amounted to $28,759,398, the amount paid in dividends was $8,793,216, and a balance of $5,190,953 is carried to surplus.

Shawinigan Water and Power Co.

The accounts for 1927 show earnings of $9,362,838 gross and $3,294,782 net, as compared with $7,660,207 and $2,957,323, respectively, in 1926. Total dividends of $2 per share have been paid, and $1,091,850 is carried forward.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors recommend a balance dividend on the ordinary shares of 1s. 1.223d. per share, making up the standard dividend for the year.

Davis & Timmins, Ltd.

The profit for 1927 rose from £3,747 to £6,639. The final ordinary dividend is at the rate of 10 per cent. per annum, free of tax, making 8 per cent., tax free, for the year, as in 1926.

Ericsson Telephones, Ltd.

The net profit for 1927 was £27,005, against £44,599 for 1926. The ordinary dividend is 5 per cent. Last year 8 per cent. was paid, and there was also a 200 per cent. scrip bonus.

Northern Mexico Power and Development Co.

Dividends of 1¾ per cent. on the preference stock and 1 per cent. on the common stock have been declared in respect of the quarter ending March 31st.

Bell Telephone Co. of Canada.

This company is seeking permission to increase its capital to $150,000,000 for further developments. Revenue from all sources increased during 1927.

Canadian General Electric Co., Ltd.

A dividend of 1¾ per cent. has been declared on the preference stock in respect of the quarter ending March 31st.

Waste Heat and Gas Electrical Generating Stations, Ltd.

A final dividend of 6¼ per cent. has been declared, making 8 per cent. for the year, as for 1926.

German Companies.

The *Wolfram Lamp Company*, Augsburg, the share majority of which is held by the German Osram Company, reports net profits of 77,000 marks for 1927, as against 68,000 marks in the previous year. A dividend of 12 per cent. has been declared, against 10 per cent. for 1926.

The *Emag Electricity Company*, Frankfort-on-Main, proposes to increase its dividend from 6 per cent. to 7 per cent. for last year.

The *C.I. Vogel Wire and Cable Works Company*, Berlin, has declared a dividend of 6 per cent. for 1926-27, as in the previous year. At the recent meeting it was announced that negotiations were proceeding for raising a foreign loan, which is partly intended for extensions of the works.

Swiss Company.

The *Aluminium Industrie, A.G.*, Neuhausen, reports that the net profits increased from 10.92 million fr. in 1926 to 11.83 millions in 1927, and the dividend is again at the rate of 15 per cent. It is also proposed to pay out of the special reserve fund a bonus of 100 fr. per share. As blocks of shares are passing increasingly into foreign ownership, the directors intend to take defensive measures by recommending the creation of 50,000 registered preference shares of 100 fr. each, which are to be allotted exclusively to Swiss shareholders.

French Company.

The *Société Centrale pour l'Industrie Electrique*, Paris, reports having participated in capital increases carried out by various companies in 1927. The net profits last year amounted to 5,253,000 fr., and the dividend is 50 fr. per share.

Stocks and Shares.

MONDAY EVENING.

ALTHOUGH the lurid accounts of the "boom" and of fortunes made and lost in about five minutes that have been appearing in the lay Press recently must be taken with a considerable amount of salt, there is no doubt that the past week has witnessed an extraordinary amount of activity in practically every department of the "House." With the exception of rubbers there is hardly a market which has not participated in the excitement. There is a considerable amount of speculation about, and some of it is very "ragged," but thanks to the very restricted carry-over facilities available there is not likely to be any trouble, as the only other source of finance left to those who have outrun the constable are the banks, who can be safely trusted to keep things well under control. A most hopeful sign is the continually expanding investment demand, which is growing side by side with the present wave of speculation. The Gilt-Edged Market has been in very good form in spite of the bad reception accorded to the new Australian Government Loan, and practically every first-class long-term stock on offer is quickly absorbed. It is hardly necessary to say that the Industrial Market continues to be a vortex of excitement, with incidents far too numerous to mention here.

Home Rails.

Metropolitans rose sharply during the week on anticipation of an announcement of a merger, or at least close working arrangement with the Underground Group, but relapsed somewhat on lack of confirmation. The feature has been the steady rise of Underground ordinary to at one time 24s. x.d. on the cheerful speech of the chairman at the annual meeting, coupled with the possibility of a new issue on bonus terms. The 6 per cent. income stock has also been in strong demand on conversion prospects, and hardened to 112. Districts were also a good market in sympathy, and at 70¼ x.d. more than recovered the dividend. By the way, the directors of the Underground Company must have a keen sense of humour. The meeting last year was held at the company's offices, Broadway, Westminster, and one or two shareholders present suggested that as the city was now taking such a close interest in the affairs of the company the directors might be well advised to hold the annual meeting nearer the City in future. This year it was held at—Caxton Hall! The reports and meetings of the main line railways being past and done with, things were inclined to dullness, with a certain amount of stock being turned out to provide funds for commitments incurred in more active sections. There was at the same time a little lock-up buying in evidence, and Great Western ordinary at a shade under par x.d. was in moderate demand.

Excitement in Electrics.

Home Electrics have been in such an excitable state all the week, and features have been so many, that it is difficult to know exactly where to start. The centre of attraction has been the ordinary shares of those companies operating in the Home Counties, and shares have been aggressively bought regardless of price. A new one to be brought into the arena this week was Isle of Thanet Electric. Both ordinary and preference were in strong demand, and were rushed up to 31s., a rise of over 8s. and 6s., respectively, and this in spite of the rather unsatisfactory dividend announcement (4 per cent.) for last year. The preference later went back to 27s. Metropolitans, North Metropolitans, Urbans, Eghams, Richmonds, Chiswicks, and Electric Supply were very active all the week, and Bournemouth and Poole ordinaries, almost entirely surrounded by rumours, were at one time not very far off the £4 mark. The following small table showing prices a week ago, the highest since, and to-night's closing prices of the principal companies which have been in the limelight as a result of the recent Edmundson's deal, is illuminating :—

	March 5th.	Highest since.	To-night.
Bournemouth and Poole	68/-	77/-	73/3
Electric Supply	47/6	56/-	52/9
Metropolitans	45/-	50/-	46/-
North Metropolitans ...	41/-	45/-	43/6
Eghams	27/6	31/-	31/-
Isle of Thanets	21/-	33/-	30/-
Urbans	55/-	57/-	56/-

These increases have only been effected by a considerable number of shares changing hands, and as there are practically no carry-over facilities here, all commitments have had to be taken up and paid for, from which it is clear that the buying has been of a substantial character, but dealers are at a loss to say how much, if any, has been buying for control and how much is pure speculation. Counties were thrown overboard on the dividend announcement, and at one time were down to 33s. 3d., from which they subsequently recovered to round about 35s. There has been a very large business in the new London Power 5 per cent. debenture stock on the basis of 1¼ premium, free, and also a good deal doing in the new Hendon Electric 5 per cent. debenture. Here the price is par, also free. There has been the usual business in the London Companies without many price alterations, with the exception of City Lights, which, for no apparent reason, were pushed up to 34s.

Power Companies, &c.

Although the Home Counties Group have monopolised most of the limelight there has, at the same time, been a good deal passing in the various power companies' shares, which are all higher on the week. Newcastles, after initial weakness on the dividend, which caused disappointment in some quarters, hardened to 26s. 6d., with the new 25s. 9d. bid. Newcastle and Districts were in inquiry, and are 25s. 6d. upwards. Yorkshire new ordinary were active with a lot of shares changing hands round 7s. premium, but the old were unmoved at 32s. Midland Counties at 26s. 6d. x.d. are a good 1s. up on the cheerful meeting, and Northamptons were inquired for around 35s. Midland Corporation for Power Distribution ordinary jumped smartly to 66s. as a result of the declaration of 100 per cent. share bonus. Shropshire "A's" were in demand at 32s. 6d., with the "B's" close behind, and both Scottish Power and Lancashires touched the 30s. mark, which should all be very cheerful reading for shareholders. Things were inclined to be slow in the Foreign and Colonial Section. There was a fair amount doing in Atlas ordinary and preference, but not up to the usual standard, and prices remained stationary. Mexican Lights were inclined to harden and were at one time 70 bid. The 7 per cent. preference was down to 75 at one time, but afterwards recovered, and was unchanged on the week. The $5 4 per cent. 2nd preference were changing hands around 50s.

Tramways.

The London Tramways were influenced by the activity in the Underground Group, both London Suburban Traction and London United Tramway preferences being over 1s. up in sympathy. The ordinaries were also harder at 2s. 9d. and 2s. respectively. London United Tramways 4 per cent. debenture is also better at 57½. Potteries, both ordinary and preference at 4s. and 5s. respectively, were active on the official announcement of the abandonment of the tramways and the change-over to omnibuses. The annual meeting is being looked forward to with interest, as it is the chairman's intention then to deal with the situation. Lancashire United Transports were dull on selling by people wanting money for commitments elsewhere, and have sagged to 7s. The market considers that the present price presents a good buying opportunity for locking-up purposes in view of the persistently good traffics. The 6 per cent. debenture stock was in small demand at 99. The feature of the foreign tramway section was the commencement of dealings in the no-par-value shares of Hydro-Electric Securities Corporation, in which hectic movements were witnessed. A little speculative buying of some of the non-dividend payers was in evidence, and both La Platas and Pernambucos were better, the latter being 1s. 3d. up at 8s. on absorption rumours. Brazil Traction were inclined to dullness, but the British Columbia Electric Railway issues were all better, the deferred being 209 bid. Apart from the above there was not much of interest, speculative attention being fixed on Home Lighting shares.

Cables.

The only thing that can be said about cables this week is that owing to lack of news there has been a certain amount of selling by speculators who think they can see opportunities of using the money thus realised in the more active departments and then getting back again on the same level, if not lower, a little later on. Whether they will be able to do so or no remains to be seen, but the result has been small drops in practically every case, as will be seen from our list of prices. Marconis, after initial weakness, became very active, at one time topping the £3 mark. A circular issued by the company with reference to the 6½ per cent. debentures has drawn attention to their conversion rights, and the price rose sharply to 166, a gain of some 16 points. Canadian Marconis were also in some demand, and at 15s. 6d. were the best part of 2s. up on the week. Marconi Marines have also been fairly active, and at one time were 41s. bid.

Manufacturing.

Electrical Equipment shares have been very erratic this week. Metropolitan-Vickers have been a funny market, jumping to 32s. 6d., a rise of over 3s., in spite of the none too good report, but, generally speaking, things have been a bit off colour. General Electric ordinary were 1s. down, as were English Electric ordinary, and Siemens were marked down to 30s., a drop of 1s. 6d. There is a considerable amount of "sitting on the fence to see which way the cat is going to jump" about this group at the present moment. It is not at all clear whether the Dudley Docker-Met.-Vickers deal foreshadows a closer working arrangement between electrical manufacturing companies which will be to the advantage of proprietors, or whether the alleged American purchases of English lighting companies will result in American firms obtaining orders for plant and equipment required by the supply companies, which hitherto have been given to home manufacturers. A dull spot was British Aluminium ordinary, which dropped to 50s. on doubts as to the return to the 1925 rate of dividend. Callenders, Henleys, British Insulated, and, in fact, all the cable manufacturing group, were in steady demand. Westinghouse Brakes at 27s. and Consolidated Signals at 35s., were both lower and without interest. There was a little doing in Greenwich Cables on the report and declaration of a six months' dividend on the preference, and shares changed hands during the week at 16s. 9d., with the ordinary 3s.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Mar. 12. 1928.	Rise or fall.	Yield.
Home Electricity Companies.	£					p.c.
Bournemouth and Poole	1	14†	14†	73/3	+5/3	3 16 6
Brompton Ordinary	1	10	8⅝	25/6	—	5 9 10
Charing Cross Ordinary	1	15	8½	26/6	—	5 5 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	26/-	—	5 7 8
City of London	1	15	10	31/6	—	4 8 11
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	34/-	—	4 14 2
County of London	1	15	7½	35/6	—1/-	4 4 6
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundsons' Ordinary	1	8	10	67/6	—	2 19 2
do. 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	52/9	+4/3	4 3 4
Kensington Ordinary	1	15	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	30/-	+1/6	5 0 0
London Electric	1	10	8½	25/6xd	—	5 9 10
do. do. 6% Pref.	5	6	6	5½	—	5 8 2
Metropolitan	1	11	8	46/-	+1/6	3 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	6	6	26/6xd	+1/-	4 18 1
Newcastle-on-Tyne Ordinary	1	7	5	26/6	+1/6	4 10 7
do. 5% Pref.	1	5	5	18/-	—	5 10 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	5	17½	8	26/6xd	—6d.	5 5 8
South London	1	15	8½	26/-	—	5 7 8
South Metropolitan Pref.	1	7	7	1¼	—	5 8 0
Urban Ordinary	1	7	7	56/-	+1/-	2 10 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	26/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/-	+1½d.	6 16 4
Yorkshire Elec.	1	8	8	32/-	—	5 0 0
Home Rails.						
Central London Ord. Assented	Stock	4	4	74	—	5 8 1
Metropolitan	,,	5	3	67xd	+1	4 9 7
do. District	,,	3½	3½	70½xd	+½	5 13 6
Underground Electric	£1	Nil	1½	23 4½xd	+1/4½	4 5 6
do. do. Income	Bonds	6	6	112	+5	5 7 2
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	92½	—2	6 9 9
do Def.	,,	1½	1½	22½	—½	6 11 10
Automatic Telephone	1	3	10	47/-	—9d.	4 5 1
Chili Telephone	5	5	6	7⅞	—	3 18 3
Eastern Extension	10	10	10	15	—½	*6 13 4
Eastern Tel. Ord.	Stock	10	10	140	—5	*7 2 10
Globe Tel. and T. Ord.	10	10	10	15	—½	*6 13 4
do. do. Pref.	10	6	6	10½	—	5 17 1
Great Northern Tel.	10	20	20	88½	—½	5 3 11
Indo-European	25	8½	10	35	—	*6 1 5
Marconi	10/-	Nil	5	59/3	+1/3	1 13 3
Marconi-Marine	1	7½	8¾	41/-	+1/-	4 5 4
Oriental Telephone Ord.	1	12	12	51/3	—	*4 13 6
United R. Plate Tel.	5	8	8	10⅜	—	*3 15 3
Western Telegraph	10	10	10	15½	—½	*7 5 6
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	9⅜	—	7 6 8
do. do. 2nd Pref.	5	6	6	8⅞	—	7 17 4
do. do. 5% Deb.	Stock	5	5	78½	—1½	6 7 5
British Electric Traction Def. Ord.	,,	—	—	515	—	... ...
do. do. 8% Pref. Ord.	,,	7	8	124½	—	6 8 6
Brazil Traction	100	5	6	206½	—2	2 18 1
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	—	5 6 11
do. do. Preferred	,,	6½	6½	165½	+5	*3 15 5
do. do. Deferred	,,	8	8	210	+5½	*3 16 2
do. do. Deb.	,,	4½	4½	88½	—1	5 1 10
London & Sub. Trac. 5% Pref.	1	Nil	Nil	8/-	+1/6	... ...
London United Tram Deb.	Stock	4	4	57½	+2	6 19 2
Mexico Trams, 5% Bonds	—	5	5	80	—1	6 7 5
Mexican Light Common	100	Nil	Nil	72½	+5	... ...
do. 7% Pref.	100	Nil	Nil	78	—	... ...
do. 1st Bonds	—	5	5	79½	—	6 9 4
Yorkshire (West Riding)	1	5	—	7/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	69/-	—	3 15 4
British Aluminium Ord.	1	12½	10	50/-	- 2/6	*4 0 0
British Elec. Transformer Pref.	1	7	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	4½	—	3 12 8
Brush Ord.	1	10	10	29/-	—	6 17 11
Callenders	1	15	15	4⅞	+⅛	3 11 7
do. 6½% Pref.	1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord.	1	—	—	17/6	—	... ...
Edison-Swan	4/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	90	—	5 11 0
Electric Construction	1	10	7½	26/-	—	5 15 5
Enfield Cable Pref.	1	7½	7½	26/3	—	5 14 3
English Electric	1	Nil	Nil	7/6	—1/-	... ...
do. do. Pref.	1	6	3	11/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	7½	7½	35/-	—1/-	4 5 9
Henley	1	20	25	5½	—	4 10 11
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	Nil	13/9	+9d.	... ...
Johnson & Phillips	1	17½	12½	63/9	—	4 12 7
Met.-Vickers Ord.	1	8	8	32/-	+2/6	3 15 0
do. Pref.	2	8	8	2⅜	—	6 1 11
Siemens Ord.	1	7	7½	30/-	- 1/6	5 0 0
Telegraph Construction	12	10	10	23½xd	—1	*5 1 0

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

The British Industries Fair.—V.

Descriptions of Exhibits Concluded.

In this issue there appear further photographs of stands at London and Birmingham, and the illustrated notes on the exhibits in both sections are brought to a close.

As we have stated on previous occasions, the indications are that the electrical section at next year's Fair will be even larger. Already space has been booked by exhibitors, and a number of firms which have not hitherto taken part have also applied for stands. It certainly appears as though all the time available between now and next February (for we think that that date will be retained) is needed for the laborious work of organisation which the Fair entails, and electrical manufacturers should render all assistance in their power to the organisers to make things run smoothly.

We do not think that the general arrangements can be bettered in any drastic fashion, but attention has been drawn to a number of details which should be attended to; these include such matters as seating accommodation, better train arrangements, the making up of the outside roads, &c. It has to be remembered that the Castle Bromwich Buildings are only used for a very small portion of the year, but there is now such a feeling of permanence in connection with the Fair, that the expenditure involved would not be wasted.

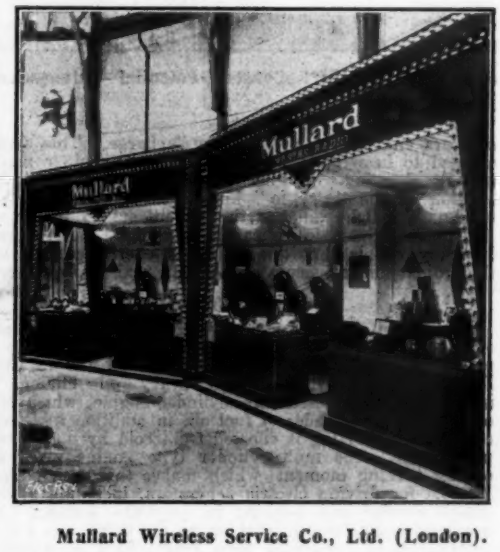
With regard to the London Section, whilst the display of British manufactures in all the branches of industry that were represented reflected the greatest credit on the producers of the goods, which reached a very high standard of quality and finish, it is to be regretted that the buildings in which they were housed were so ill-adapted to show them off to the best advantage.. It has been suggested that a permanent exhibition building should be erected, as at Birmingham, and there is much to be said in favour of this proposal.

Certain public spokesmen have not failed to recognise that in such events as trade Fairs and exhibitions everything is to be gained from the closest possible co-operation between the Trade Press and the authorities responsible for the organisation of the shows, not forgetting the valuable aid that can be given by exhibitors acting as an organised body. Comment has been made upon the generous editorial interest that the Electrical Review and other trade and technical journals have taken in the various exhibits, but it has not always been recognised by exhibitors that considerable benefit to themselves and convenience to buyers ensues from their advertisements in the trade journals appearing in advance of and during the run of the Fair, containing matter of an especially appropriate character.

Siemens Bros. & Co., Ltd. (London).

Credenda Conduits Co., Ltd. (Birmingham).

Electric Fires, Ltd. (Birmingham).



Mullard Wireless Service Co., Ltd. (London).

Some Further Electrical Stands at the 1928 Fair.

Some of the Exhibits.

Details and Illustrations.

Lancashire Dynamo and Motor Co., Ltd.

Upon this stand appeared examples of the company's "Maxtorq" motor and a new type of d.c. motor. The latter machine represents the latest design, and embodies ball and roller bearings and laminated poles, positively driven fan, mica insulation, railway track slide base, and most accessible brush-gear. There was also a working demonstration of the "Crypto" constant-potential battery charging set (fig. 29), by means of which batteries can be coupled up direct to the

Fig. 29.—"Crypto" Constant-Potential Battery-charging Set.

bus-bars and receive a "tapering" charge. This system is claimed to have great advantages over any other means of battery charging. Another exhibit was a working demonstration of the "Crypto" kinema arc-lighting set for a.c. mains. The light value of the current supply to the arc by this means is said to be particularly high, and, further, the company claims that the saving in energy cost as against the ordinary motor-generator set is approximately 30 per cent.

Crossley Bros., Ltd.

This exhibit included examples of oil engines built at each of the company's four factories, ranging from 150 b.h.p. down to 3 b.h.p. The largest engine on the stand was a "Crossley-Premier" multi-cylinder type heavy oil engine. This is a horizontal enclosed three-cylinder engine, which operates on the cheapest grades of fuel oil, in addition to Diesel and crude oils. Starting is effected from cold by means of compressed air. The multi-cylinder type engine gives a very regular turning moment, which makes this design especially suitable for driving electric generators, including alternators direct coupled and working in parallel. Another Crossley heavy oil engine shown working on the stand was a 48-b.h.p. single-cylinder horizontal open type. This is typical of a range of single-cylinder engines built from 22 to 140 b.h.p., or, when arranged with double cylinders, up to 280 b.h.p. An example was shown of a Crossley vertical two-stroke oil engine which is built in four sizes, ranging from 6 to 20 b.h.p. These engines are low in first cost, and will burn as fuel, Diesel oil, gas oil, and certain grades of fuel oil, and they have a separate air scavenge pump. The one shown develops 10 b.h.p. as a normal working load. Pump lubrication is provided to all the main moving parts. These engines are totally enclosed to exclude all dust and dirt, and are suitable either for industrial or electric driving purposes. A 3-kW petrol-paraffin engine, as used for driving machinery for the farm and for electric lighting work, was also shown.

Reavell & Co., Ltd.

A number of compressors of various types formed this company's exhibit. Among them were a 150-lb. pressure portable garage pump driven by an electric motor, and the "Substation" portable blower for cleaning electrical machinery.

R. A. Lister & Co., Ltd.

This company exhibited a range of engines, a pumping plant, and "auto-trucks." The electrical equipment included a 1-kW 32/43-V plant and a 1½-kW Type No. 35 Plant (50/73 V). The equipments are entirely self-contained, consisting of engines fitted with heavy electric lighting type flywheels completely eliminating flicker, so that the plants may be used for direct lighting if required. The engine is direct coupled to a dynamo capable of maintaining the full output at any voltage from minimum to maximum, either on battery charging or direct lighting. The dynamo is provided with special facings carrying the radiator for the efficient cooling of the engine, this radiator being of sufficient capacity to cool the engine efficiently in tropical climates if necessary.

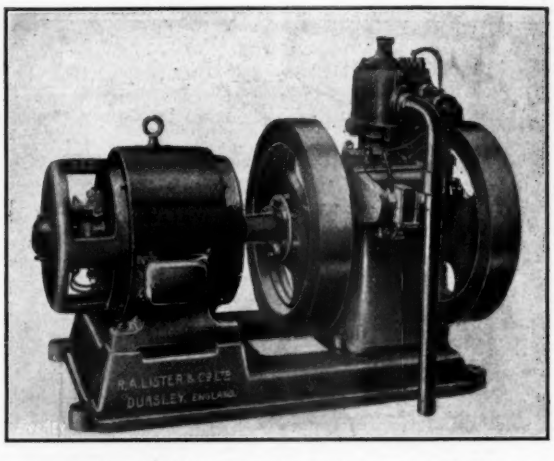


Fig. 30.—A "Lister-Bruston" Automatic 3-kW Set.

The air is drawn through the radiator by means of a fan running on ball bearings. A switchboard, of special design, is mounted above the dynamo. The fuel tank is mounted on the plant so that the whole equipment is entirely self-contained.

The company also exhibited a 3-kW fully-automatic "Lister-Bruston" plant (fig. 30). This plant is fully automatic. For small loads the battery deals with the requirements, and on the load exceeding a predetermined amount, the relay closes, enabling the plant to start up, the set dealing direct with the load until such time as the load is reduced below a certain figure when the relay opens and the plant stops. During the period the plant is running the voltage is regulated by a magnetic governor working in conjunction with the centrifugal governor.

Ruston & Hornsby, Ltd.

On this stand there were a 20-b.h.p., cold-starting, horizontal oil engine for working on a wide range of cheap fuel oils, and a 57-b.h.p., cold-starting, vertical oil engine (three cylinders). The latter engine is particularly suited for generating electricity. A patented feature of the Ruston engine is the fuel distributor gear which ensures an equal distribution of fuel to all cylinders, thus avoiding the danger of one cylinder carrying more than its proper share of the load. The engines are made in sizes up to 1,000 b.h.p. A subordinate exhibit was a two-stage air compressor, belt driven by an a.c. motor, for charging self-starter air receivers.

Blackstone & Co., Ltd.

This company had two stands. On one appeared oil-engine plant, and "unchokeable" pumps were shown on the other. The power plant exhibit included several examples of the company's cold-starting engines fitted with the spring-injection system. The main item was a 195-b.h.p. horizontal engine (three-cylinder), and there was also a special small generating set (3-kW). Three sizes of petrol engines were shown, one of them coupled to a 1-kW generator. These are fitted with an automatic governing device for the carburettor which automatically adjusts the feed according to the load.

S. G. Brown, Ltd.

This exhibit comprised ships' apparatus, including a standard gyro compass and accessories, such as bearing repeaters, special switchboard, &c. Loud-speaking telephones were also shown, as well as the company's horn- and cone-type loud-speakers

National Gas Engine Co., Ltd.

Among a number of examples of this company's engines an interesting item was the "National-Michell" crankless gas engine. In this engine the crank and connecting rod are eliminated and the reciprocating motion of the piston is converted into a rotary motion by means of slipper pads and a slant, the latter being fixed on the main shaft. The pistons run with a true harmonic motion and perfect balance can be obtained with three or more pistons. The engine exhibited developed 10 b.h.p. at 1,200 r.p.m. It was direct coupled to a generator made by Electromotors, Ltd., the whole unit being mounted on a common baseplate. A sectional drawing of the engine is reproduced in fig. 31.

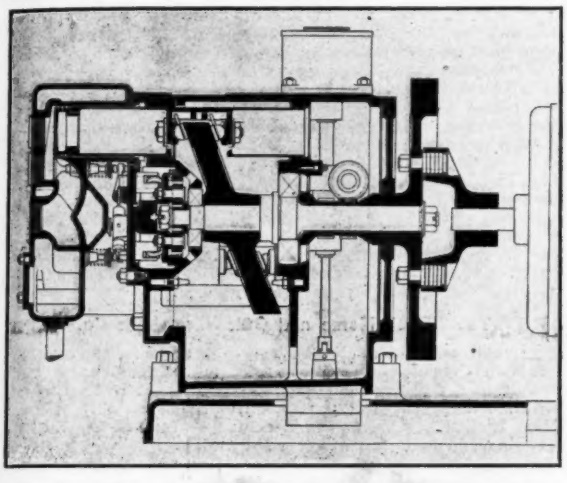


Fig. 31.—The "National-Michell" Crankless Gas Engine.

Another exhibit was a four-stroke, horizontal single cylinder engine developing 2½-3 b.h.p. at from 800 to 1,000 r.p.m., running on petrol-paraffin, or town's gas. The crankcase is totally enclosed, and the lubrication is entirely automatic. This engine is particularly suitable for agricultural work and house lighting plants.

The company also showed several other of its engines.

Stuart Turner, Ltd.

Three sizes of small lighting sets were displayed on this stand, viz., 0.12, 0.5, and 1.5 kW. The "Stuart" ½-b.h.p. engine has recently been redesigned.

Donovan & Co., Ltd.

A substantial display of ironclad "Safuse" gear was built up upon this stand. The components included distribution boards with switches, fuses, &c. Examples of a wide range of power switch-plugs—rated at from 5 to 100 A—were shown, and other exhibits were fan regulators and kindred appliances.

Castle Fuse and Engineering Co., Ltd.

A variety of fuse-gear was exhibited by this company. One of the principal features was a range of eight "Triumph" fuses, with capacities of from 5 to 300 A, arranged for various applications. The fuse assemblies shown illustrated heavy industrial service types in iron cases and small domestic distribution boards.

Davis & Timmins, Ltd.

In addition to a large display of screws, bolts and nuts, this company showed samples of metal repetition work for electrical and general engineering purposes, including terminals, &c.

H. E. Ashdown (Birmingham), Ltd.

This display was composed of many examples of bakelite mouldings, including switchplates, adaptors, plugs and sockets, lampholders, &c., as well as samples of mica and mica products.

Thos. De la Rue & Co., Ltd.

Synthetic-resin in many forms was exhibited by this company, particular attention being drawn to the ease with which metal parts could be moulded into the material. Fireproof and acid-resisting insulation was also shown.

Rainsford & Lynes, Ltd.

This company had a bright display of lighting fittings and brassware. Included in it were handsome standard lamps, bowl fittings, reading lamps, and shades. The chief accessories shown were lampholders and ceiling roses.

Damard Lacquer Co., Ltd.

Two stands (in Buildings A and C) were shared by the above company with MOULDENSITE, LTD., and BAKELITE, LTD., and they bore numerous examples of the companies' synthetic-resin mouldings, moulding powders, lacquers, cements, &c.

Petters, Ltd.

Upon this stand appeared eight examples of oil engines. The largest was a 70-b.h.p. "C" type heavy oil engine by Petters (Ipswich), Ltd. This type is made in sizes of from 25 to 600 b.h.p. The principal items of electrical interest were an "Alpha Petter" 750-W generating plant and a 3-kW set. The former comprises a 1¼-h.p. "M" type engine belted to a dynamo, carried on a cast-iron bedplate. A switchboard

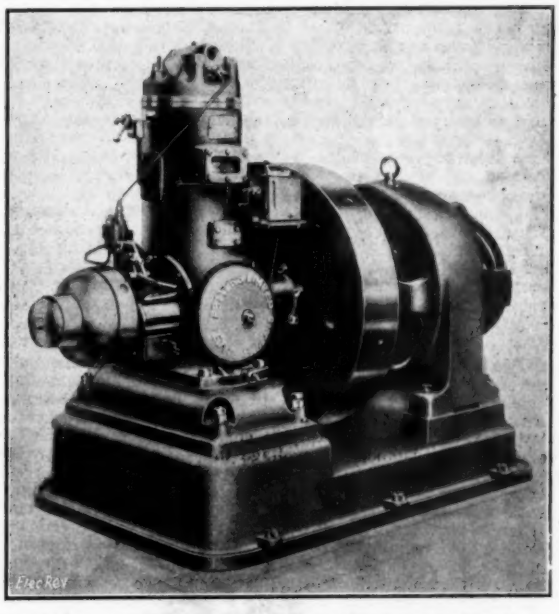


Fig. 32.—A "Petter" Direct-coupled Generating Set.

is provided, together with a motoring switch for starting the engine. The 3-kW plant, of the type illustrated in fig. 32, comprises a 5-b.h.p. "S" type engine for running on paraffin or light fuel oil, direct coupled to a dynamo on a cast-iron bedplate. The engine starts instantly from cold by means of the Petter patent cold starter, and on account of its exceedingly smooth running and efficient sensitive governing is particularly suited for driving an electric generator. The engine is fitted with single heavy disk flywheel. The whole forms a very compact and simple electric generating unit. This set was shown in operation.

National Union of Manufacturers.

This was a joint exhibit by about 20 companies. Among them appeared MESSRS. D. H. BONNELLA & SON, LTD., with examples of automobile electrical fittings and artistic work in metal and other materials; the CENTRAL MANUFACTURING CO., small electrical measuring instruments, including radio and automobile patterns; HAILWOOD & ACKROYD, LTD., illuminating glassware; and the BROWNIE WIRELESS CO. OF GREAT BRITAIN, LTD., synthetic-resin mouldings for electrical and radio purposes, &c.

W. H. Sugden & Co., Ltd.

The "Blick" washing machine was displayed on this stand. The "Model B" combines a number of functions, being a dish-washer, clothes-washer and boiler. The machine is operated by electricity or gas as required.

Electrical Power Engineers' Association.

This Association held a stand in order to draw attention to its activities and important position in the electrical industry. Mr. Arthur Jones, the general secretary, was in attendance during the Fair to explain the Association's work to interested callers. A number of small exhibits by electrical manufacturers appeared on the stand.

Hollings & Guest, Ltd.

A new exhibit by this company was a series of positive action rotary pumps for handling liquids of both low and high viscosity. Examples of hydraulic presses were also on view. One of these was a hot-plate press specially designed for the manufacture of insulating materials, such as rubber, bakelite, fibre, &c. Samples of moulded pressings in bakelite were shown. Other exhibits were baling and tire presses and hydraulic valves.

Other Exhibitors.

In addition to the companies and firms whose exhibits have been dealt with, the following concerns had stands of electrical interest:—TELEGRAPH CONSTRUCTION & MAINTENANCE CO., Ltd. (resistance and magnetic alloy wires, strips, &c.); JOHN HARPER & CO., LTD. (high-permeability castings for electrical purposes); BRITISH SANGAMO CO., LTD. (meters, including prepayment patterns, electrically-wound clocks, &c.); CLEAR HOOTERS, LTD. (magnetic horns and push-buttons); BERRY, WIGGINS & CO., LTD. (joint-box and battery-sealing compounds, &c.); SMALLS, LTD. (mica and micanite); MILKANIC,

Ltd. (electrical centrifugal milk-making machine); Filtrators, Ltd. (feed-water treatment); Express Electric Heating Co. ("Dome"-type heaters); Watertight Fittings Co., Ltd. (lighting fittings for mines and factories, armoured cable grips, &c.); Rawlplug Co., Ltd. ("Rawlplugs" and tools, and aluminium fittings); Northern Rubber Co., Ltd. (rubber insulation, &c.); Eastern Telegraph Co., Ltd. (information bureau); Bromford Tube Co., Ltd. (weldless steel tubes, poles, &c.); Tubes, Ltd. (cold-drawn weldless steel tubes); Richard Johnson, Clapham & Morris, Ltd. (copper and steel wire and sections); Streetley Manufacturing Co., Ltd. (bakelite mouldings); Liptak Furnace Arches, Ltd. (sections of furnace construction); Boulton & Paul, Ltd. ("Electrolite" small generating set); Birmingham Electric Furnaces, Ltd. (ovens and regulating gear); Henry Wiggin & Co., Ltd. (nickel-chromium alloys for electric heating apparatus); Crosthwaite Engineering & Furnace Co., Ltd. (self-clearing furnace and mechanical stoker); E. Green & Son, Ltd. (economiser sections, &c.); Tangyes, Ltd. (i.c., engines including a 19-b.h.p. electric-lighting type); British Electrical Repairs, Ltd. (examples of dynamo and motor repairs); Wolseley Sheep-Shearing Machine Co., Ltd. (small generating sets); A. B. Cleworth & Co., Ltd. (furnace construction); and Accles & Pollock, Ltd. (weldless steel and stainless steel tubes, &c.).

Allen-Liversidge, Ltd.

Two stands were held by this company. One of them was devoted to acetylene plant, &c., while the other bore examples of electric-welding plant, including a "Pontelec" resistance welder, and an "Alda" single-operator arc welder. In the latter the drooping volt-ampere characteristic avoids the use of a series resistance, the voltage dropping immediately the arc is struck. On the switchboard (which is mounted on the bed-plate) is a diverter resistance across the series windings with four tappings to give coarse adjustments, while finer regulation is provided by a rheostat in series with the separately-excited field windings. The driving motor can be either d.c. or a.c.; in the latter case a small exciter is fitted for the separately-excited windings. A fixed reactance is connected in the arc circuit and this, together with the special arrangement of the field, enables the generator to respond rapidly to variations in the arc conditions, with the result that a stable arc is secured and the tendency for the electrode to stick on striking is reduced to a minimum. The stabilising reactance consists of an iron core with a copper winding of large cross section, so that it absorbs a negligible amount of power, the stabilising effect being produced inductively and not being dependent upon resistance.

London Section.

Fuller Accumulator Co. (1926), Ltd.

Much-improved accumulators were shown on this stand, for wireless purposes, automobiles, and stationary installations. The cells are fitted with ebonite separators, and have ebonite, celluloid, or glass containers, some types being fitted with ebonite tops. The high-tension radio batteries have rubber covers, cast lugs, large terminals, and rubber separators between the glass cells; they are rated at 3,000 mAh, and are made up in 20-volt acid-proof crates. Filament batteries were also on view, with a complete range of motor-car starting and lighting batteries, and accumulators for train lighting and house lighting. The "Sparta" loud-speakers, and a new cabinet cone-type speaker, were exhibited, and dry cells both of the ordinary and of the inert type, including batteries up to 60 volts, and elements for Leclanché cells.

Graham Amplion, Ltd., and Alfred Graham & Co., Ltd.

These companies had a large stand well equipped with a variety of their well-known apparatus. The former showed the standard Amplion public speaker and band repeater equipment, which has been installed in many hotels and other buildings; it is arranged for use with both microphone and gramophone, and the controls are so simple that skilled attendance is dispensed with. From two to 16 loud-speakers can be operated by sets of corresponding capacity.

Messrs. Alfred Graham showed a large collection of the marine-type telephones, for which they are noted—audiphones for giving orders, naval and mercantile telephones, hooters, fire-alarms, &c. The pillar-type telephone, the new "Cabin-'phone," which gives multiple-way communication up to six positions, and fire-control gear, were interesting features of this exhibit.

Fig. 33.—The Graham Cabin-'phone.

C. Creswick Atkinson.

Some excellent examples of artistic cabinets combined with thoroughly up-to-date radio receivers were shown at this stand. The "Nulli Secundus V" sets, which are also made in portable form, embody five valves and a loud speaker of the balanced armature type.

Burovox, Ltd.

Much interest was displayed in the new Burovox inter-telephone instrument, which has already been adopted in a number of large offices, hotels, on ships, &c. The instrument comprises a transmitter, earphone, receiver, and a distributor; by means of the last, by simply turning the dial to the number desired, connection can be made with any department of a large building. Combined with the earphone is a device whereby the messages can be diverted to a miniature horn-type loud speaker set up in any part of the room or office. The transmitting microphone is of a special type, operated off a 12-volt dry battery, so that it is not necessary for either the person transmitting or receiving the message to be near the instrument. Indeed, we witnessed a demonstration when both persons were some distance away from the instruments, and conversation was successfully carried on, reception at both ends being from the loud speakers. The system has been also adapted for use on covered motor vehicles to enable the passengers at the rear to give instructions to the driver, while a new development is the inclusion of an echo sounder for use in connection with merchant ships and war vessels in order that an indication of the depth of water below them may be readily ascertained at any time.

The British Home and Office Telephone Co.

Having now been established nearly forty years, the internal telephone systems of this company are so well-known and widely used as to call for but brief notice. It will suffice to mention that all types of equipment suitable for all purposes, from that of private houses and small offices to the largest building and factories, are available. The systems are automatically worked, that is to say, connection between any of the instruments is obtainable without the need of switchboard attendants, while the range includes every variety of wall and desk-type instruments. Attention is also again being drawn to the company's "Extendaphone" attachment, which enables a receiver to be swung round and extended to any position within its range.

The Electron and Beyond.

Lecturing at Girton College recently, Sir J. J. Thomson (as reported in *The Times*) described how recent experiments, especially those made by Professor G. P. Thomson on the passage of electrons through very thin films of metal, had thrown quite a new light on the nature of the electron. They had proved that a uniformly moving electron was accompanied by a train of waves which preceded and guided it, the electron following in the wake of the waves. The electron had thus, like light, a dual structure; one part, that containing the energy, was corpuscular; the other, the part controlling and guiding the path, was undulatory. The waves which accompanied the electron vibrated far more rapidly than the hardest Röntgen rays; the only rays approaching them in this respect were the gamma rays from radio-active substances. The vibrations were quicker when the electron moved fast than when it moved slowly, but however slowly it might move, the waves never made fewer than a very large number of vibrations per second. Short as these waves were, their lengths were more than 10,000 times the diameter usually ascribed to the electron. These results showed that the early conception of the electron as a point-charge of negative electricity surrounded by a structureless medium could not be adequate; the electron or its surroundings must be much more complex—there must be something beyond the electron.

Technical Education in the Irish Free State.

The Irish Free State Ministry for Education has issued the report of the Commission appointed to inquire into, and advise upon, the system of technical education in the Free State in relation to the requirements of trade and industry. The report says that if the State is to secure the much-needed national development in which the Shannon Electricity Scheme and other enterprises will form a prominent part, it is of paramount importance that there should be persons of the highest scientific and technological qualifications to fill key positions. If, therefore, courses designed to produce persons to fill key positions are not provided in the Universities, it will be necessary to have in the Saorstat a higher technological institute. Whole-time schools of secondary technical education will also be required. The advantages of technical education must be more thoroughly realised in industry, commerce, and trade. Without the active interest and support, both of the employer and the worker, no form of technical education can survive. As the success of the schemes of technical education will depend to a very great degree on the qualifications of the teachers and their interest in their work, adequate arrangements should be made for their training, and fixed minimum scales of salaries should be adopted.

The Ideal Home Exhibition.

A Review of the Electrical Features.

(*Continued from page 441.*)

The House of the Future.

A BRIEF reference has already been made to "The House of the Future," which is attracting so much attention at the Exhibition, and which may be regarded as an endeavour to show in concrete form the progressive electrification of domestic utilities and amenities that may in time bring us to the stage when electricity is the only form of non-human physical energy employed in the average house. This electrical dream has been translated into material form by a well-known architect, Mr. R. A. Duncan, A.R.I.B.A., assisted by the engineers of the British Thomson-Houston Co., Ltd., the latter being generally responsible for the electrical work. Practically everything connected with the house is electrical.

It is difficult in the limited space at our disposal fully to describe the many beautiful lighting effects, or the great number of purposes for which electricity is utilised; some idea can, however, be gathered from the fact that the total connected load of the house exceeds 40 kW. Notwithstanding this load, those responsible for the exhibit go so far as to imply that the general public some day may not have to worry about electricity bills, but that power will be obtained from the ether by means of a special form of inducer plant fitted at the top of a 40-foot steel mast adjoining the house!

Beginning with the garden, one finds that it contains a triangular fountain from which a waterway runs between two main pathways. Both fountain and waterway are provided with a system of illumination embodying hundreds of small Mazda lamps sprayed in three different colours and arranged in three separate circuits controlled by a motor-driven mechanical dimmer, which continually changes the sequence of the lamp circuits in such a way that the water is illuminated consecutively with red, amber, purple, green, &c. General illumination of the garden is obtained from eight B.T.-H. floodlight projectors, each fitted with a 500-watt lamp, mounted on two 16-ft. ornamental masts.

Extending across the front of the house is a verandah, illuminated from three wall fittings of special "modernist" design, while the entrance hall is lighted by lamps of various colours situated behind a glass ceiling, the outer portions of which are illuminated with rich red colour fading gradually inwards to other tints. The living quarters of the house form one large room which may be divided up at will by means of roller shutters concealed in the ceiling. The illumination is on the indirect principle from six colour-changing fittings supplied by Messrs. Holophane, Ltd., and equipped with eighteen 500-watt Mazda projector lamps, controlled from three manually operated liquid dimmers. Decorative lighting is also provided by special brackets so constructed that they may be fitted to wall sockets, clipped to chairs, &c., or used as table standards. In the study a large cabinet and writing desk accommodates a B.T.-H. wireless receiving set with an R.K. amplifier and loud-speaker and transmitting set. Also available are a Telenews writer, a Dictaphone, and a television apparatus, as well as a gramophone embodying the latest electrical reproduction and amplification, and an electric piano. In the kitchen cooking is facilitated by a Hotpoint electric inducer-type oven and hotplate, while other interesting features are an electrical refrigerating plant and an electric geyser; by means of the latter boiling water is available immediately a local hot-water tap is turned on. The housewife's labour is also greatly reduced by the installation of electrically operated washing and ironing machines, and other electric appliances.

There is no inside staircase to the house, internal communication being secured by means of a Hammond-Champness press-button electric lift. The main corridor on the first floor is illuminated by means of gas-filled lamps fitted behind special alabaster ceiling panels, decorative lanterns being also mounted on the walls. Leading off the corridor are one large bedroom and four bunk bedrooms, the latter being separated from each other by roller shutters, so that two of the rooms may be converted into one larger room if desired. The main lighting of the large bedroom is effected by what may be termed the "Runolite," this being a large, rectangular fixture, triangular in section, which forms the decorative ceiling cornice. The fitting is constructed of glass panels, and in all accommodates thirty-four Mazda "tubular" lamps. Additional illumination is provided by suitably designed wall brackets and standards. A novel bedroom innovation is a wireless amplifier and loud speaker let into one of the wall panels, while local illumination of the beds is provided by lamps housed in special reflectors supplied by Restlite, Ltd.; the beds are equipped with Thermega electrically heated blankets.

The shower bathroom is probably one of the most spectacular features of the house; the walls and ceiling are completely covered with alabaster panels illuminated from the rear by 150 Mazda lamps. An artificial sunlight apparatus and other appliances for health and hygiene are also available. The exercise room contains various therapeutic and other electro-medical appliances supplied by the Ajax Co., Ltd. Over the car garage at one end of the house is situated a large bathing pool, around which lighting effects are produced by means of B.T.-H. "Linelite" fittings. The roof of the pool is constructed of plate glass, and in the centre of this is an Ajax therapeutic fitting. Spectacular colour effects are produced over the pool by means of floodlighting through the glass roof.

Other interesting and novel features of the house are an outside staircase with electrically illuminated glass risers, internal heating by means of electric panels in the floors, and an ozone air-ventilating system for use at night-time when windows may be closed. Time is recorded throughout the house by magnetically operated clocks supplied by the Magneta Time Co., Ltd., and there is also an automatic intercommunication telephone system supplied through the Telephone Development Association. A feature in connection with the garage is that the roller shutter can be opened by the driver without having to alight from the car, all that is necessary being to switch on the headlights, either during the day or at night; the beams of light from the lamps act on a special apparatus fixed near the garage door, this in turn operating an automatic device by means of which the roller shutter is immediately raised.

The heating, lighting, ozone air, and all the other electrically operated equipment of the house are controlled from a central switchboard supplied by the B.T.-H. Co., which may be regarded as the heart of the whole installation. Finally, it may be mentioned that the whole of the wiring work in the house was carried out by Messrs. Duncan Watson & Co., Ltd., and some idea of the difficulties that had to be contended with may be realised when it is stated that no less than two miles of C.T.S. cable, over 1,000 lamps, and all the other electrical appliances employed in the installation, had to be fitted and completed within approximately fifteen days.

The General Electric Co., Ltd.

The General Electric Co., Ltd., is to be congratulated on its efforts to popularise still further the use of electrical apparatus and appliances for home use, its display at the exhibition being not only the largest in the electrical section, but also, it is claimed, most comprehensive. The centre of the rectangular stand, fig. 2, is devoted to a general exhibit of household appliances, with a diverse selection of electric light pendants and fittings disposed at various points, the arrangement being such as to indicate to the public the correct fittings for use in the different rooms of a house.

Among the individual fittings to which attention may be

Fig. 2.—The G.E. Co.'s Stand.

drawn are two table standards and a floor standard. The table lamps, which are of the candelabra type and of French make, represent the Roman period in the two model human figures, while the surrounds have been copied from outstanding designs of the same period. The floor standard, which is of a striking Empire period design, comprises five carved brackets supporting imitation candles and Osram candle lamps. The standard itself, which has the appearance of metal rather than wood, is finished in gilt.

The household fittings on view embrace the complete range of "Magnet" domestic appliances, of many of which continuous demonstrations are being given. Among the latter is an electrically driven combined washing and wringing machine (the "Wizard") so constructed that by simple attachments it may be used for several other purposes. The new "Magnet" suction cleaner is also shown in operation on a variety of uses to prove its utility and efficiency. The latest machine is of similar design to the former model, but embodies a num-

ber of improvements which add both to its efficiency and appearance. At the mouth of the inclined nozzle is a stationary brush with bristles set widely apart for straightening out loose threads, hairs, &c., which are afterwards absorbed by the suction. At the same time the brush presses back the pile of the carpet so that the dust may be drawn from the weave and knots, and even from the underside of the carpet. The motor is of the Witton "universal" type suitable for a.c. or d.c. supply, and has a consumption of only 140 watts.

One of the sub-divisions of the stand is set out as a sectional bathroom, among the electrical features of which are a "Magnet" geyser, shaving mirror, shaving pot, and towel rail. Three new forms have been added to the range of reflected lighting shaving mirrors. By means of an Osram lamp at the rear of the mirror, the latter is so warmed that it is unaffected by steam or mist, and consequently is always clear. The face is illuminated by the light of a lamp concealed behind the mirror in such a way that its rays are projected upwards by a reflector of special curved design, which avoids glare and shadow. The fitting is finished in white, washable enamel with opal glass shelves, and is provided with a "Magnet" bakelite non-tarnishable lampholder.

On the stand is also an electric kitchen fitted with "Magnet" cookers and a number of small cooking appliances, together with an electric water heater. Adjacent to it is a section of a bedroom, the bed of which is provided with a new and effective design of overhead light (fig. 3), while the dressing table is set out with a massage vibrator, ultra-violet-ray equipment, and electric curling tongs. Another of the sections of the stand is constructed to resemble the scullery of a middle-class home, it being equipped with appliances intended to reduce the labour incident to clothes washing. Copious supplies of hot water are rendered available by means of an electric water heater. Another interesting domestic appliance is a sewing machine operated by a fractional h.p. motor (fig. 4), while reference may also be made to the combined electric bell and burglar alarm installation for houses so arranged that while serving as a call indicating system during the day, at night it can be connected up to the window and door contacts and to the bell indicator in the main bedroom, where, if any of the windows or doors are tampered with, an electric bell is caused to ring continuously.

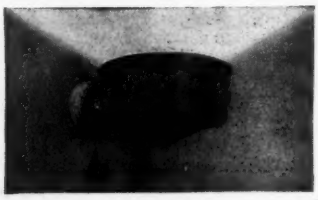


Fig. 3.—Reflected Lighting "Over-bed" Unit.

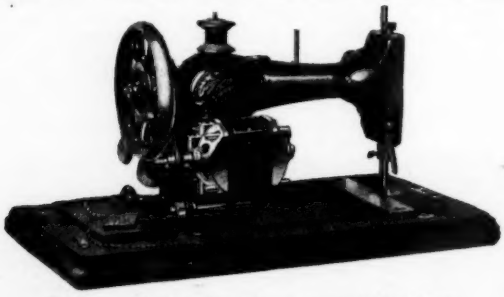


Fig. 4.—Electrically-driven Sewing Machine.

Fig. 5.—Electromagnetic Gramophone Pick-up.

Two sides of the stand are flanked by benches on which examples of the G.E.C. wireless sets and components are displayed, together with bells and accessories, bakelite electric light components, and a number of industrial appliances. Displays of Pearl Osram and Osram lamps and radio valves form still another feature of the exhibits, while attention may be directed to the "Magnet" electric gramophone motor and the "Gecophone" gramophone pick-up, both of which are becoming popular selling lines. One of the disadvantages of the ordinary gramophone is the frequent need for re-winding the clockwork mechanism. The G.E.C. has overcome this drawback by introducing the "unit electric gramophone drive," a self-contained fitting which comprises a small electric motor mounted on a frame with governor and speed adjuster, coupled to the turntable spindle. The motor is designed to give a constant driving torque at all voltages over 50; it is wound for low pressure only, the excess voltage being absorbed by an Osram lamp, which acts as a buffer to compensate for any rise or fall in pressure.

Now that radio loud-speakers are being used in connection with gramophones, much interest is being taken in the Gecophone pick-up (fig. 5), a device which takes the place of the usual gramophone soundbox. Owing to the great sensitivity of the pick-up, the volume of sound obtained through radio earphones with no intervening amplifier, is more than equal to what is commonly regarded as good crystal-set strength, while ample loud-speaker volume is obtained when used in conjunction with a two-valve receiving set. For radio constructors a volume control, in the form of the Gecophone high-resistance potentiometer and a special jack and plug, is supplied by the makers, the arrangement being such that all valves in the receiver not required for amplification are cut out automatically.

Ransomes, Sims & Jefferies, Ltd.

This old-established Ipswich engineering firm, which has for some years been manufacturing lawn-mowers driven by petrol engines, has lately introduced an electric mower known as the "Electra," which, as its name implies, is operated electrically. The machine, which is made in three sizes, is intended for use in the gardens of houses, hotels, clubs, &c., where a supply of electric power is available through one or more plug-in points fixed in convenient positions in the garden. The all-enclosed electric motor, of the firm's own construction, is of ¾ h.p. in the case of the 20-in. machine. The mower can be worked off a single plug-in point over a radius of about 50 yards, it being thus possible to mow, for example, a bowling green from a single electric point. The 20-in. machine weighs approximately 3 cwt.

The Reliance Telephone Co., Ltd.

In order to bring home to the minds of manufacturers, merchants, and even the general public the time-saving value of an internal system of telephones, this company has again arranged an attractive exhibit showing the Reliance and G.E.C. systems adapted for installation in both large and small buildings, hospitals, &c. Examples are shown of instruments by means of which calls can be made from any floor to one central point, or, alternatively, calls between any two instruments without the assistance of a switchboard operator.

At the stand are also to be seen examples of the G.E.C. 25-line and 50-line automatic exchange units, suitable for installation in large banks, offices, &c. The units are so constructed that all desired connections are automatically effected so that no operators are necessary and all conversations are private. The design allows for the incorporation if desired of special telephonic facilities such as executive control, fire-alarm service, conference lines, and of loud-speakers, &c. The exhibit also includes various signalling apparatus, burglar and fire alarms, and several telephonic labour-saving devices.

The Artisco Co., Ltd.

A prominent position is given on this stand to "Peco" hand-decorated glassware in the form of a wide variety of electric lamp shades, the feature of which is that the decoration is worked on the interior of the shades, with the result that it is non-fading and entirely unaffected by any exterior cleaning or washing. A wide range of novel and artistic electric light fittings in brass, copper, bronze, and cast-iron, at extremely low prices, is also on view. Among these may be mentioned some attractive wall fittings and pendants, the latter including some four-arm lights, in the form of reproductions of cathedral gargoyles.

Part of the Artisco Co.'s stand is devoted to a display of the productions of the Hendon Electric Lamp Co., Ltd., including a range of the Hendon electric lamps, the "Eltron" electric immersion heater, a simple device by means of which half a pint of water can be brought to the boil in about a minute, a foot and bed warmer, electric irons, toasters, and the Hendon two-way adaptor.

Bristow & Co.

Electric lamp shades form the speciality of this firm, which displays them literally in hundreds of different patterns and designs, the shades being made either of vellum or a non-inflammable material known as Nacrolaque. A novelty consists of a small artistic shade with bulb carrier adapted to be hung on the head rail of a bed to form a convenient reading lamp.

(To be continued.)

Insulating Oils for H.P. Cables.

The authors discuss the variations which occur in cable dielectrics as the result of the differing characteristics of insulating oils.

By T. N. RILEY, M.Sc., and T. R. SCOTT, B.Sc.

(*Abstract of a Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

MOST published work has dealt with switch and transformer oils, and while cable oils have many requirements in common with these, the latter have certain special requirements to which attention is directed in the paper. Oils suitable for high-voltage cables are, in general, equally suitable for low-voltage work, but many of the characteristics which are of importance for high voltages are of minor importance when the stress in the dielectric is low, and the range of oils available is therefore increased.

Chemically there are few fundamental requirements, since it is the physical and electrical properties which mainly determine the most suitable compound. Although at one time vegetable oils were largely used, it is usual at the present day to employ pure hydrocarbon (mineral) oil as the main constituent. In order that the compound used may have no injurious effect on the material impregnated, or on the adjacent metals, it must be free from inorganic or organic acids. Its chemical structure should also be stable, so that its characteristics will not change with time or the application of temperatures attained in manufacture or service.

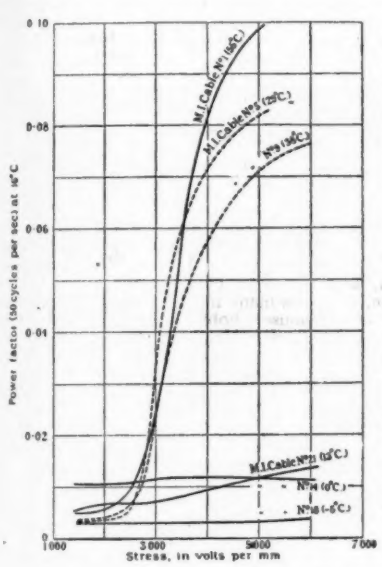


Fig. 1.—P.F.-Voltage Characteristics with Oils at Various Set Points.

Physically the compound must have the properties of a lubricant in order that the paper layers may slide over each other without fracture when the cable is handled, and its viscosity must be sufficiently low at the impregnating temperature to permit of thorough impregnation of the paper. On the other hand, it must be sufficiently high at service temperatures to prevent easy drainage when the cable is laid on a slope or when it is cut for jointing. The desirability of a high viscosity under working conditions applies only to cables of the normal structure, and not to the type having a continuous oil channel connected to reservoirs. The compound must not, however, have a definite set point within the working range of temperatures, or the capillary channels in the dielectric will be blocked as the cable cools after impregnation, and there will be a risk of the formation of voids.

When an oil cools down from a temperature at which it is completely fluid there is, in general, no point of sudden change to the non-fluid condition. Two points are usually distinguished: (*a*) that at which the oil becomes cloudy owing to the precipitation of solid paraffins, and (*b*) the temperature (set point) at which the oil has zero fluidity.

Fig. 1 illustrates the power factor-voltage characteristics of six cable samples all insulated with the same paper, but having impregnating compounds of different set points. The three oils whose set points are above normal atmospheric temperature all show distinct ionisation points, indicating the existence of voids in the dielectric. The oils having low set points give flat power factor-voltage characteristics, although the actual value varies according to the oil used. It should be noted that up to a stress of 2,000 V per mm. No. 14 appears to give worse results than No. 1, although, because of its freedom from ionisation, it is a better cable. Low power factor at low stresses is not a criterion of quality.

It has been common practice in certain cases to add resin to the impregnating compound. The effect of the addition of resin is to raise the set point of the oil, as shown in fig. 2, and from this point of view the addition of resin is distinctly injurious. It is better to choose an oil of naturally high viscosity rather than to obtain high viscosity by adding resin.

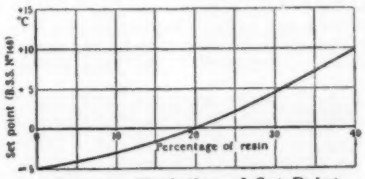


Fig. 2.—Variation of Set Point with Resin Content.

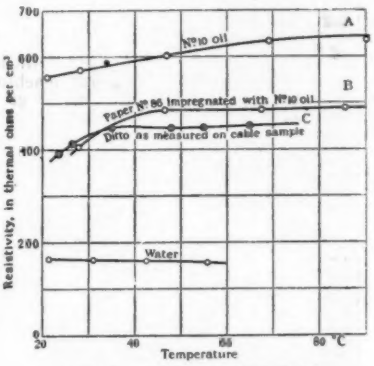


Fig. 3.—Thermal Resistivities.

The thermal resistivity of the oil should be low in order that the cable may run cool in service, but the variation in the thermal resistivity of dry oils is small, and what is of even greater importance, the oil should completely fill the spaces between the paper fibres. It is perhaps not generally appreciated that while the thermal resistivity of the paper fibre itself is rather lower than that of the oil, the resistivity of the contacts between layers of dried paper is of the order of five or six times that of the oil. Imperfect impregnation will, therefore, raise the thermal resistivity. In making tests of thermal resistivities of paper, it is necessary to adopt special methods in order that the results may not be entirely masked by the contact resistance between layers. Tests on the thermal resistivity of oils previously published have indicated that the resistivity falls considerably with rise of temperature. Such results are, however, mainly due to convection currents in the oil, and tests made with Lee's apparatus, in which convection is excluded, give the results shown in fig. 3. If the thermal resistivity of an oil is of the order of 600, and that of the paper of the order of 1,200—as given by previous writers*—it would not be possible to obtain thermal resistivities of 550 on the finished cable. The explanation is that the thermal resistivity of the paper is really between 200 and 300, and that high values quoted by previous observers are due entirely to bad contact with the fibres and to the air between the fibres.

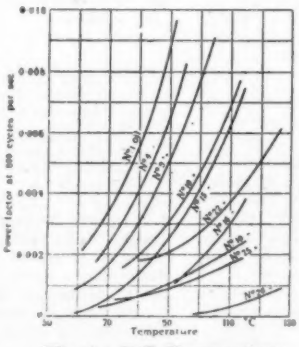


Fig. 4.—P.F.-Temperature Characteristics of Oils.

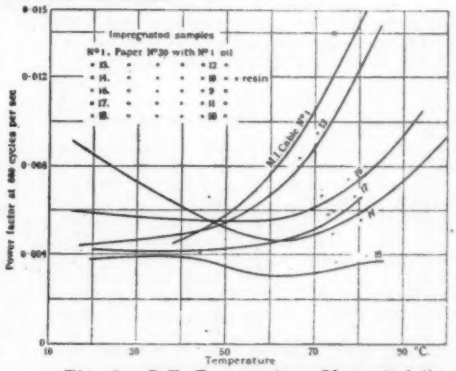


Fig. 5.—P.F.-Temperature Characteristics of Cables.

Electrically the compound should have the lowest possible a.c. conductivity over the working range of temperature, in order that the dielectric losses may be low in service. In oil specifications a breakdown test is commonly specified. This is of minor importance, as many oils can be obtained which, when clean and dry, will give high breakdown tests, although their conductivities are much too high for satisfactory

* Beaver, "Insulated Electric Cables."

cable work. On the other hand, any oil which is satisfactory as regards conductivity is also satisfactory from the breakdown point of view. If G is the a.c. conductivity and C the capacity of the sample under test, the power factor of the oil is very near $G/2\pi fc$, where f is the frequency. Fig. 4 shows the power factor-temperature characteristics of various oils as supplied by the refiners, except that they have all been vacuum dried. Two curves are given for oil No. 10 to illustrate the wide variations possible in new consignments of the same oil when the supplier is controlling his material by chemical tests only. The advantages to be gained by using an oil of low loss value and minimum temperature coefficient are illustrated in fig. 5, in which the same paper was used for a series of oils. Cable No. 1, impregnated with oil No. 1, which was shown to be worst in fig. 4, is also worst in a finished cable. A comparison of curves 14 and 18 shows that the effect of resin is in general to increase the losses and move the minimum point to the right. Fig. 6, showing comparative power factor-temperature characteristics of the paper, the oil, and the cable at various frequencies, indicates that the characteristics of the finished cable are governed mainly by the paper characteristics at low temperatures and by the oil characteristics at high temperatures.

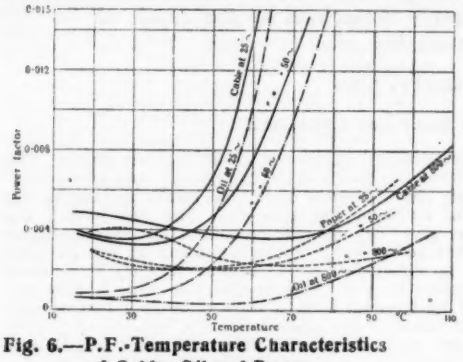


Fig. 6.—P.F.-Temperature Characteristics of Cable, Oil and Paper.

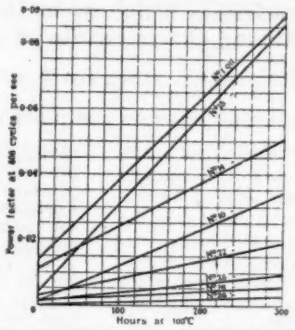


Fig. 7.—Variation of P.F. of Oils with Heating in Air.

In Table I the percentage changes of various characteristics before and after heating are given. It is clear that the change of power factor is by far the most sensitive test. Oils which behave satisfactorily on this test are also satisfactory from the sludging point of view; and, owing to its greater sensitivity, it has been suggested that it might be usefully employed instead of a sludge test for transformer oils, although the power factor of the oil is not of the same importance in transformers as in cables.

It is desirable that any oil for use in cables should have the least possible rate of deterioration. It is true, of course, that a completed cable is not exposed to air, except in so far as imperfect impregnation may have left traces of air in the dielectric. In the factories, however, the hot compound will be exposed to air for short periods, and the less liable the compound is to change the more uniform will the product be. Fig. 7 shows—for various oils—the variation of power factor with duration of heating in air. A compound which changes little on heating is also of particular importance to the manufacturer, since it has hitherto been found impracticable to restore the power factor to its original condition by any chemical or mechanical methods.

In order that the comparative results obtained may be reliable, it is necessary that the treatment of each sample should be under complete control as regards temperature, pressure, degree of drying, &c. Apparatus employed to secure these results is shown in fig. 8. In order to carry out the drying and impregnation of the sample cable a special form of impregnating tank was designed. This tank may be exhausted down to a vacuum of 1 mm. of mercury or, alternatively, positive pressures of up to six atmospheres may be applied. The tank is fitted with external electrical heating, and electrical resistance thermometers inside the tank permit of accurate temperature measurement and control. Interchangeable terminals are fitted so that it is possible to carry out low-voltage measurements, high-voltage measurements, or thermal measurements. For the thermal measurements the cable may be heated by passing current through the core.

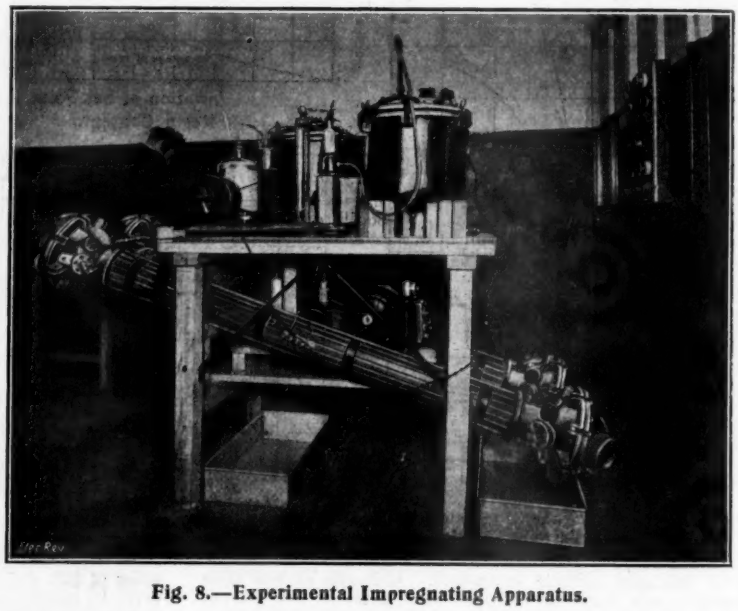


Fig. 8.—Experimental Impregnating Apparatus.

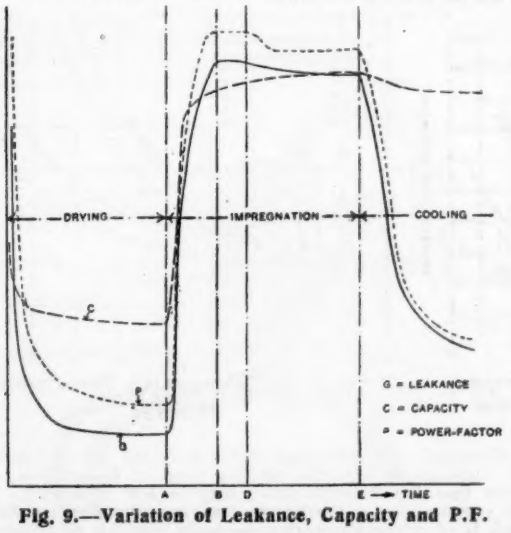


Fig. 9.—Variation of Leakance, Capacity and P.F.

TABLE I.

	Before heating.	After heating.	Percentage change.
Viscosity (centipoises) at 15°C.	998	951	− 4.5
Viscosity (centipoises) at 85°C.	42.6	41.25	− 3.17
Density, grammes/cm³ at 15°C.	0.887	0.8875	+ 0.05
Specific inductive capacity at 100°C.	2.195	2.22	+ 1.1
Refractive index	1.4963	1.4961	− 0.01
Total acidity expressed as % H.	0.00008 %	0.00015 %	+ 87.5
Water soluble expressed as % H.	0.000028 %	0.000032 %	+ 14.5
Power factor at 100°C.	0.0055	0.0334	+ 507
Sludge	—	Trace	—

The oil to be used is vacuum treated in the tank shown on the top of the table, which is capable of withstanding a similar range of pressures. The oil characteristics are measured by immersing a plate condenser in the oil. When experiments on oil alone are being carried out the plate condenser is immersed in a special bath which may be made of different materials, so that any catalytic effect may be detected. Arrangements are made for admitting the compound direct from the oil tank to the impregnating tank, without breaking the vacuum. The experimental samples consist of a standard .3 square inch copper strand over which the paper to be treated is wrapped. An outer layer of metallised paper serves as the external electrode, and at the same time permits free impregnation. The conclusions drawn from the small scale tests have proved correct when subsequently applied in the manufacture of full factory lengths.

While measurements have been made under a wide range of frequencies the control tests have usually been made at 800 cycles. Measurements of the leakance and capacity

at this frequency have been carried out to ensure all samples in a series of comparative tests being brought to a standard starting-point as regards drying of paper and oils. The state of impregnation is also shown by the rise of capacity. Typical curves for the variation of capacity and leakance during drying and impregnation are shown in fig. 9. The same method has been successfully applied to control of drying and impregnation on a factory scale (see British Patent 275,721).

Discussion in London.

Mr. G. H. NASH, in opening the discussion, said that the paper was full of revolutionary statements which would soon be regarded as correct. One thing that stood out was the control of the process of drying and impregnation. There was no generally known method which would permit observations to be made during the process, but the method described in the paper made the process absolute. With regard to the characteristics given by the author for oil before and after heating, he thought the most important point was the non-ability to form sludge. The great change in the power factor suggested that in that connection was the proper method of selecting suitable oils.

Mr. C. J. BEAVER remarked that the paper represented the first attempt that he had seen upon any real correlation between the physical properties of oil. The paper was likely to give the impression that there was only one method of impregnation, and that that involved low viscosity. On the screen he showed some curves which depicted the results of investigations by him into the question of power factor. The difference in the p.f.-voltage characteristics of a cable before and after it had been wound over six times from one drum to another was shown to be very slight. He illustrated and briefly described apparatus which he had brought out for observing the physical behaviour of cable under the influence of temperature changes. Plotted results indicated that the cable was not permanently distended. He suggested that e.h.p. cables behaved in the same manner as l.p. ones as regarded the oil expansion. Referring to the question of cables for hilly country, he remarked that a contract had recently been awarded for cable for installation in a South African gold mine, where there was a gradient of one in one. He thought that a lot of the difficulties which had been raised were not matters of necessity.

Captain P. DUNSHEATH thought that in stating the advantages of using high-viscosity compound, the authors should make it clear that they were not decrying resin. He suspected that the authors had never found a case of dialysis where resin was used. He gathered that the authors regarded the set point as important, but he submitted that this did not come into account, as it did not vary by more than about 2 deg. after the first five minutes. He complained that the power factors given in the paper were not found in actual practice, and said that the selection of the oil was by no means the whole story; by complying with all the authors' conditions, it was possible to produce bad cable where good oil was used. He hoped the veil would soon be drawn off some of the "obscure" parts of the paper.

Mr. P. V. HUNTER wished to correct any suggestion that the selection of oils by reason of their power factors was of recent origin; it was done 20 years ago.

Prof. MCGREGOR MORRIS put forward a plea for further study as to what power factor really meant. He thought that it was used in a way which covered up the real fundamentals. It was worth while trying to examine the relations between the volt-wave and the ampere-wave and to ascertain the effect of varying frequency.

Mr. P. M. BAKER pointed out that the permanent set in the lead sheath was in the horizontal direction. It seemed to him that the copper expanded more than the lead. It would be interesting to know how far oil pressure had anything to do with the matter.

Col. EDGCUMBE, who, in the absence of Mr. Page, was in the chair, asked what was meant by a thermal ohm and the centipoise.

In replying to the discussion, Mr. RILEY said that he had found the control of the impregnation most useful; it was no longer a question of working in the dark. By determining that the power factor at, say, 800 cycles, was below a certain figure, it could be safely put down as O.K. at 50 or 25 cycles. That the paper called for low viscosity was not the idea at all; high viscosity was desirable providing it was not obtained at a temperature above the practical limits. Below certain temperatures there must be voids. He could not see how Mr. Beaver could get his cable absolutely free from air. Referring to Mr. Beaver's experiment for showing the expansion of the compound, he asked if the cable was full at first; it was possible to get a p.f.-voltage characteristic absolutely flat.

Mr. SCOTT also took part in the reply. Referring to the query about resin, he said a lot depended on how the makers dealt with it. If one altered its physical characteristics, the electrical characteristics were also altered. He had seen a cable in which dialysis in connection with the resin had occurred, but the cable also contained "cheese"; it was useless to make a general law. Regarding the suggestion that the power factors in the paper were too high, he said that for the oils referred to high power factors must be obtained. He thought that it was a pity that the power-factor measurements of 20 years ago were not published and taken up with the oil suppliers; the question was still to-day asked: What is power factor? The set-point variation was not the issue—but variation of viscosity. He agreed that power factor was not the whole story; all the cable components must be considered.

Mr. RILEY likened the thermal ohm to the ohm by comparing heat drop to volt drop, and explained that the centipoise was the international unit of viscosity.

Electricity Supply—1925-26.

Return of Engineering and Financial Statistics by the Electricity Commissioners.

LAST week the Electricity Commissioners issued their Statistical Return, relating to authorised undertakings in Great Britain, for the year ended March 31st (or May 15th), 1926, for local authority undertakings, and December 31st, 1925, for company undertakings (H.M. Stationery Office, price 12s. net).

The number of authorised undertakers at the end of the period covered was 593, comprising 2 joint electricity authorities, 3 joint boards, 355 local authorities, and 233 companies and persons—an increase of 30; but the numbers actually engaged in electricity supply were 3 joint boards, 317 local authorities, and 216 companies—a total of 536, representing an addition of 25 to the previous year's total. As some undertakers operate in more than one area, the number of separate undertakings for the purpose of the Return is taken as 565 (320 local authorities, and 216 companies with 245 undertakings).

Generating Plant.

In 298 cases all the energy was generated locally, in 142 it was derived from bulk supply, and in 125 both methods were used. There were 491 generating stations having a total capacity of 4,421,602 kW, of which 277 stations (67.2 per cent. of plant) were owned by local authorities, and 214 stations (32.8 per cent.) by companies. The addition to plant capacity during the year amounted to 698 088 kW; of this 124.000 kW was accounted for by adjustments in ratings, but the remainder was far beyond the average increase of the five preceding years (300,000 kW per annum). The difference was partly due to the opening of new stations at Barking, Broomgrove, North Wilford, and Stourport. The largest station was that at Dalmarnock (112,500 kW). Fifty-two stations, having over 25,000 kW installed, contained 2,538,390 kW of plant, or 57.4 per cent. of the aggregate; and of the remaining 439 stations, over 200 had less than 1,000 kW each. Steam plant comprised 98.35 per cent. of the total, oil-engine plant 1.03 per cent., gas-engine plant 0.44 per cent., and water-power 0.18 per cent. Of the total, 91.6 per cent. was alternating, and 8.4 per cent. direct current; 89.8 per cent. of all the generating plant installed consisted of steam turbo-alternators, 120 sets of 10,000 kW or over being installed.

Systems of Supply.

Of the 491 generating stations, 155 generated a.c. only, 232 d.c. only, and 104 both a.c. and d.c. Fourteen generating frequencies were in use; 231 stations operated at 50 cycles, 18 at 25 cycles, and 11 at 40 cycles, the corresponding percentages of plant installed being, respectively, 77.0, 14.8, and 5.4 per cent. There was an increase of 556,567 kW of 50-cycle plant, and of 150.582 kW of non-standard a.c. plant. Supplies at 16 different frequencies were distributed.

Of the 565 undertakings, excluding one not supplying private consumers, 165 distributed a.c. only, 190 d.c. only, and 209 both a.c. and d.c.

Low- and medium-pressure supplies ranging from 100 to 480 volts, were given at 33 different a.c. voltages and 24 different d.c. voltages, the total number of declared voltages for both classes collectively being 38; 184 undertakings were operating at three or more declared voltages, 92 at four or more, and 19 at five or more.

Output.

The total energy generated by authorised undertakers was 6,618.6 million kWh, of which 65.7 per cent. was produced by local authorities and 34.3 per cent. by companies, an increase of 10 per cent. on the figures for the previous year. Of the total, 98.2 per cent. was generated by steam plant, 0.74 by oil, 0.24 by gas, 0.23 by water-power, and 0.59 per cent. by destructor plant and other waste heat, &c.

Energy sold amounted to 5,606.1 million kWh, 64.4 per cent. produced by local authorities, and 35.6 per cent. by companies, an increase of 11 per cent. on 1924-25. Compared with the year 1921-22, the total increase was 105 per cent. of energy sold for lighting and domestic purposes, and 79 per cent. for power. The sales for 1925-26, analysed, were for lighting and domestic purposes, 22.2 per cent.; for public lighting, 1.6 per cent.; for traction, 9.1 per cent.; and for power, 67.1 per cent.

The consumption per head of population for the whole country (43.8 millions in 1925) was about 128 kWh, which compares with 82 kWh in 1920-21 (public supply undertakings only; statistics are not given for the numerous stations belonging to private owners, at which large supplies are generated for traction, colliery, and other industrial purposes). In 21 undertakings the consumption was 300 kWh per head and over; in 26 undertakings, from 200 to 300 kWh; and in 100, from 100 to 200 kWh.

Operation.

Of the "gross public supply" (including energy generated by authorised undertakers and energy purchased from outside sources), 6.3 per cent. was used on works, 80.9 per cent. sold to consumers, and 12.8 per cent. lost in transmission, &c. Intersales of energy in bulk amounted to 8.6 per cent. of the gross public supply.

The aggregate values of the individual maximum loads on authorised undertakings were 1,872,680 kW for local authorities, and 1,026,712 kW for companies—total, 2,899,392 kW, or 70 watts per head of the population. The maximum loads on the generating stations of authorised undertakings amounted to 2,557,956 kW. The combined load factor for the whole of the generating plant of undertakers was of the order of 30 per cent. Three undertakings had a load factor over 50 per cent. (the maximum being 58.1 per cent.), 10 over 45 per cent., 22 from 35 to 45 per cent., 44 from 30 to 35 per cent., 92 from 25 to 30 per cent., and 164 from 20 to 25 per cent.

The total load connected was 7,301,403 kW (4,806,748 kW local authorities, 2,494,655 kW companies), representing 170 watts per head of the population. The ratio between the maximum load and the total load connected was of the order of 1 : 2.5, a ratio which has remained constant since 1920-21.

The amount of coal consumed was 6,996,700 tons (including 14,700 tons for gas producers); oil for boiler-firing, 21,800 tons; oil for engines, 16,400 tons; gas from external sources, 2,546.6 million cubic feet. Reducing fuel oil to its coal equivalent, the average fuel consumption per kWh generated was 2.43 lb., comparing with 2.55 lb. in 1924-25. As compared with the position in 1920-21, there was an all-round increase of 41 per cent. in the amount of electricity produced per ton of fuel. Forty-one undertakings produced over 1,000 kWh per ton of fuel, as compared with 27 in 1924-25, and 11 in 1922-23; the average fuel consumption at these stations ranged from 2.24 to a minimum of 1.61 lb. per unit generated.

Finance.

Loans sanctioned for local authorities at the end of 1925-26 aggregated £136,870,698, of which £125,663,093 had been raised; the net debt was £76,978,280. The net amount sanctioned during the year was £9,469,268.

The capital raised by companies by the end of 1925 was £62,556,756 (loan, £22,245,780; preference, £15,524,525; ordinary, £24,786,451). The amount raised during 1925 was £4,655,728.

The capital expended at the end of 1925-26 by local authorities and companies amounted to £217,038,306, the outlay during the year being £23,018,648. Generation accounted for £95,248,155 (43.9 per cent.) and transmission, distribution, &c., for £121,790,151 (56.1 per cent.). The average capital expenditure on generation alone was £21.5 per kilowatt installed, and on the complete undertakings £49.1 per kW. The sale of electricity per £100 of capital expenditure was 2,583 kWh.

The revenue from working was £42,961,098, or 1.66d. per kWh sold (local authorities, 1.68d.; companies, 1.63d.), equal to £19.8 per £100 of capital outlay, as compared with £24.6 in 1921-22. In the previous year the average price was 1.76d. The average revenue per kWh sold for lighting and domestic purposes was 3.82d. (previous year 4.20d.), this item yielding 51.4 per cent. of the total revenue; for power, 1.00d. (previous year 1.07d.), forming 40.4 per cent. of the total.

Local authorities sold 209.1 million kWh in bulk at an average price of 0.64d., companies 391.3 millions at 0.89d., the total of bulk supplies sold being 600.4 million kWh at 0.81d.

Working expenses averaged 0.94d. per kWh, a reduction from 1.73d. in 1921-22, and absorbed 57 per cent. of the revenue from working. Of the total working expenses, fuel cost 26.49 per cent., making, with other costs, a total of 44.61 per cent. for generation. Salaries and wages represented nearly 33 per cent. of the total. The average cost of generation was 0.4d. per kWh (fuel 0.24d.), comparing with 0.46d. in 1924-25. The average cost of coal was 18s. per ton; oil, 83s. 8d.; and gas, 2.8d. per 1,000 cu. ft.

The excess of revenue over working expenses was 8.5 per cent. on the capital (local authorities 8 per cent., companies 9.4 per cent.). The gross surplus was £19,657,722. Local authorities had an aggregate surplus of £11,609,361, of which 34.8 per cent. was applied to interest charges, 38.8 per cent. to loan repayment and sinking funds, 8.0 per cent. to reserve and renewals, 11.0 per cent. to capital expenditure, and 6.4 per cent. to relief of rates; the last item was the balance of £760,267 paid to the rates and £18,236 received from the rates. Companies in 1925 had a surplus of £8,048,361, of which 16.5 per cent. was paid in interest, 37.2 per cent. in dividends, 41.0 per cent. to depreciation and reserve. The average rates of dividend were 5.28 per cent. on preference and 8.77 per cent. on ordinary shares. Nineteen companies paid 15 per cent. or more on ordinary capital, 38 paid from 10 to 15 per cent.; 63 paid from 5 to 10 per cent., and 3 paid under 5 per cent. In 86 other cases the surplus was carried forward, merged in other accounts, or otherwise dealt with. At the end of the year local authorities had balances in hand in sinking funds, depreciation, reserve, and renewals funds amounting to £10,545,457, and companies £15,948,752.

Employés.

The staff and workmen employed numbered 45,284, their occupations being generation 17,806, distribution 20,232, and administration 7,246. The number increased by about 4,000 in 1925-26, as compared with an average increase of 2,500 in each of the two preceding years. The salaries and wages charged to revenue account amounted to £7,979,000. About 10 persons were employed per 1,000 kW of generating plant installed.

Tables.

The foregoing particulars are based upon a series of 32 "Summary Tables" in which the analysis is carried much further; and these are followed by the Return proper, which, together with the index of authorised undertakers, occupies 508 pages.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Foreign Electrical Plant.

On March 6th, Sir PHILIP DAWSON asked the Minister of Transport whether he would give the names of the local authorities owning electrical undertakings which had placed orders for electrical and steam plant and machinery abroad during the last three years; and the value of the plant.

Colonel W. ASHLEY said that neither the Ministry of Transport nor the Electricity Commissioners were, in the ordinary course, notified when either local authorities or companies owning electrical undertakings made purchases abroad. In those circumstances he was not in a position to furnish the information desired.

Sir P. DAWSON then asked whether, in the case of a selected station under the Electricity (Supply) Act, 1926, any steps were taken by the Electricity Commissioners or by the Central Electricity Board to ensure that any plant which might have to be installed was such as, having regard to all the facts, would produce electricity at the lowest possible cost.

Colonel ASHLEY said that the Electricity Commissioners, before giving their consent to the installation of plant in selected stations, satisfied themselves generally that the plant was such as would fulfil the purpose for which the station would be operated under a scheme on account of the Central Electricity Board.

On March 8th, Sir P. DAWSON asked the Minister of Health whether his attention had been called to the number of orders for electrical plant which had been, and were being placed by municipalities abroad owing to the lower wages, longer hours, and lower taxation abroad; and whether, in view of the effect on unemployment, any steps would be taken to call the attention of the local authorities to this aspect of the question.

Mr. CHAMBERLAIN said that loans for plant for electricity undertakings were not subject to his sanction. Circulars had been issued on a number of occasions to local authorities urging the use of British goods and materials wherever reasonably practicable.

G.P.O. Beam Services.

On March 7th, Sir W. MITCHELL-THOMSON, the Postmaster-General, informed Mr. AMMON that the number of messages sent or received by the Post Office beam services during the week ended February 26th was: Australia, 7,130; Canada, 4,686; India, 15,122; and South Africa, 8,516.

There was evidence that the total traffic with the Dominions by cable and wireless was now considerably greater than it was before the beam services were established.

Electricians in the Navy.

On March 8th, Mr. HORE-BELISHA asked on what basis the number of officers of and from warrant rank in each of the engineering, ordnance, and electrical branches of the Navy was calculated; and how the number of chief artificers of the engine-room, ordnance, and electrical branches were determined.

Lieut.-Colonel HEADLAM said that the number of warrant officers and officers promoted therefrom in the branches named was governed by the number of appointments for which officers of these branches were required. The proportion of chief artificers was governed by the requirements of the complements of H.M. ships and establishments.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Quarter-phase or Four-phase?

In 1888, 40 years ago, patents were granted for, and practical use was made of, the two-phase system. In those days and the years that followed, a universal and common understanding was arrived at as to the most correct definition of this system.

Neglecting the two-phase 3-wire scheme, the system is called two-phase, 4- or 5-wire *or* quarter-phase, 4- or 5-wire, and it has also been called four-phase, 4- or 5-wire.

There are four distinct two-phase or quarter-phase relations, any one of which cannot be operated in electrical parallel with any other. *Quarter-phase* would seem to more correctly define the system; on the other hand, would it be correct to say "third"-phase for the three-phase, or "sixth"-phase for the six-phase system?

May we have the views of your readers on this subject?

William T. Taylor.

London, *March 9th*, 1928.

Four-Phase Transmission.

In your issue of March 2nd it was remarked that, among the principal requirements of any power transmission system is relative security of supply, and that the best system offering this (with or without a double circuit) is the three-phase system.

As compared with the two-phase four-wire (or "four-phase" four-wire) system, the two-phase three-wire line offers relatively greater security of supply for a given locality, size of conductor, equal insulators, equal impedance drop, equal strength of supports, equal span length, &c., whether considered in terms of normal or abnormal operating conditions.

It was also stated that various comparisons can be given, and it is again mentioned that any particular pilot wire scheme is auxiliary to (or shall I say independent of) the electric power system or line itself. Actually, the basis of comparison given is the introduction of pilot wires not generally used universally.

More than 99 per cent. of the world's polyphase aerial transmissions are three-phase, and the use of pilot wires is relatively non-existent. It is unfortunate at this stage to learn that the two-phase is safer and cheaper.

William T. Taylor.

London, *March 9th*, 1928.

In your issue of the 9th inst., Mr. W. B. Woodhouse says: "the breakdown of one conductor is a condition which one has come to accept in other systems."

I am afraid we look at this question from two different points of view—he, as an overhead man, and I as an underground man, with indelible recollections of 1922-1925 breakdowns!

It has yet to be proved that the first 132,000-volt lines of insulators to be made on a large scale by British manufacturers will not give trouble, and that a mechanical failure of an insulator string will not precipitate the failure of a conductor.

This condition would at least last a day—it might last several days.

I agree that three conductors will "transmit" two-phase power in the manner suggested; but, with all due deference to Mr. Woodhouse, I do not consider it a practicable scheme.

If a breakdown occurred on one of the two conductors fed from the "main" transformer, the "teazer" transformer would be called upon to supply between 50 per cent. and 100 per cent. overload. The voltage distortion would, I believe, be something very serious, and harmonics would probably ensue.

Add to this, that the "out-of-balance" current, instead of being carried by a "neutral" cable (as in my proposal), is now *superposed* over the current in each of the other cables and, still worse, has to traverse the reactance of two transformer windings in series (already overloaded up to the hilt), and one hesitates to say what the voltage distortion might not amount to.

I may say that, for the last five years, I have been satisfied as to the value of two-phase transmission; but until I conceived the idea of working, under breakdown conditions, with two "phase conductors," *and a "neutral," with the object of equalising the loads in the "main" and "teazer" circuits*, I did not feel much hope of satisfying our "consulting engineers"—or of getting manufacturers to guarantee performances.

Even when I had done this, I was not quite satisfied because, with higher and higher voltages, I knew that the reactance difficulties in the "main" transformers (causing deficiency of voltage to be applied to the "teazer") became more and more serious.

I therefore put myself in communication with Mr. S. Austen Stigant—who is, I believe, an accepted authority—who tells me that, under arrangements described in his book, I shall be quite safe, especially as *both* windings are kept equally loaded.

I may, or may not, employ a booster in the neutral, to ensure the nullification of the drop in the latter, according to the length of line.

I submit, therefore, that a fifth (insulated) wire is necessary, to be available, as a "neutral," for emergency conditions, and that, if a "ground" wire be employed (as protection against lightning), the "ground" wire could be used temporarily to "carry on" with, for a few minutes, until the fifth, or "spare," conductor was switched into the place of the broken-down conductor, when the normal condition of things would be restored and the need for a "neutral" would disappear.

The latest advices from the United States point to the necessity of the "ground" wire anyhow.

Lastly, I may say I agree with Mr. Woodhouse's final "contention" (his letter of 5th inst.).

A. M. Taylor,
Major, S.O.2.

Birmingham, *March 12th*, 1928.

Standard Screws.

The British Engineering Standards Association has laid down a table for B.A. screws giving dimensions of threads and heads. There seems to be, however, no indication as to the actual length of threads. In that respect I have noticed that the various makers have their own standards, some threading the screws right up to the head, others again only threading up to a certain height, no matter what length the screws are.

I have looked into this question further, and find that on the Continent, for instance, there is an official specification to the effect that the length of thread on standard screws should be three times the diameter of the thread, and consequently everyone knows exactly what to expect and how to drill or tap the holes into which the screws have to fit, no matter from what manufacturer one buys the screws; could not something similar be done in this country?

Surely some of your readers have experienced trouble in this respect, and I should be glad if any of them could throw some light on this subject or state their opinions in the matter.

S.A.J.

London, *March 10th*, 1928.

The Sale of Fittings by Local Authorities.

The preliminary announcement on the above subject embodied in a letter by Mr. D. N. Dunlop, coupled with the discussion on this at the fifth E.D.A. Conference, has been most interesting reading to me, in view of my personal attitude with regard to the sale and popularisation of electrical appliances generally to the consumer.

I note that in paragraph (1) of Mr. Dunlop's letter the word "fittings" is used in an elastic and comprehensive manner, and thus embraces industrial electrical tools and machines in which the motive or thermal unit is incorporated, and in view of the notorious apathy of wholesale electrical factors and electrical contractors and retailers in the resale of these appliances, it is all to the public good that these powers should be placed in the hands of the supply authorities, who, when all is said and done, are in direct daily contact with their consumers, and are in the best position to anticipate and cater for their requirements, and at the same time educate them to the wide range of labour-saving and production-increasing electrical appliances that is at their disposal.

When all is said and done, the main object in life of the supply authorities is to load up their stations to a point at which they can sell as much energy as they can produce at the lowest possible figure; this is undoubtedly to the benefit of the community as a whole, and we think the attitude of the contractor and wholesaler is akin to that of "the dog in the manger"—they have only themselves to thank for the position that has arisen, and which they now resent, and I am sure that I voice the opinion of the general consuming public by welcoming the powers that are being extended to the supply authorities in the hope that they will make good use of these powers by catering for their consumers in the widest and most comprehensive manner possible.

A. E. Loe.
(*General Sales Manager*, B.E.N. Patents, Ltd.)

London, *March 7th*, 1928.

The Speciality Sales Engineer.

Is the speciality sales engineer a necessity from a progressive point of view? I emphatically say, yes!

Any sales engineer ought to know what he is selling, and have 100 per cent. confidence in the behaviour of his product. A speciality sales engineer can go forward, meet his client, sell the article, supervise the installation of it, and, further, whilst at any time paying a casual call on his customer, he can make, as a service which can be properly rendered in no other way, continued suggestions to his customer and any minor alterations for the more efficient use of the article sold. In no other way can a firm's business integrity be more forcibly brought home to customers than by this practice—which can only be done by the speciality sales engineer.

For example, power undertakings call out continually for fresh night loads. By utilising the speciality sales engineer's services, these loads, usually of a lightly technical nature, can be properly obtained—with no fuss, and with absolutely

no suspicion aroused on the part of the customer. With night loads the latter is a most important point.

Industrial heating probably offers the greatest scope for speciality men—provided they are trained.

I am quite confident that there is a great field for this side of the electrical industry, and if manufacturers would appoint speciality engineers for it, pay them decent living salaries, and give them the freedom always accorded to the sales staff of the motive power side, their advent would meet with gratifying results.

If customer, salesman and manufacturer would only work more in unity respecting this matter, we should certainly soon reach the desirable "cheap power" conditions obtainable abroad. The human element in the "cheap power" question has far too long been neglected.

Nichrome.

March 5th, 1928.

Switchgear Practice.

Referring to "Student's" letter on this subject in your issue of March 2nd, there is no logical reasoning connecting the two forms of supply for the protection named; they are distinct, and the following remarks will no doubt be of interest to "Student."

A 500-kW d.c. circuit of 500 V, 1,000 A requires a s.p.c.b. in the positive line and a s.p. knife switch in the negative line. The circuit is opened with the breaker, finally opening the knife switch to completely isolate the plant.

A three-phase circuit of equal capacity is best controlled by a three-pole circuit breaker, and cannot be controlled by a single-pole unit; the minimum number of poles required is two, for the following reasons:—

A s.p. breaker isolates one phase only, leaving two live phases which could not be handled on the above load by knife switches without doing considerable damage, at the same time being dangerous.

A two-pole breaker would shut the plant down, but leave one phase alive; assuming no earth, a knife switch would isolate the plant; it is essential to see that all three are opened, otherwise persons working on the plant would receive a shock from the other phase.

The best practice to adopt for the three-phase circuit is, therefore, the three-pole breaker with either three isolating links or a triple-pole knife switch of the required capacity; the latter enables the breaker to be isolated for cleaning purposes, &c.

A single-pole knife switch can also be inserted in the d.c. circuit in the positive line to isolate the breaker, for the same purpose.

For both sources of supply the isolating links or knife switches must on no account be opened before the breakers, or used for opening the circuits.

R. Oaks.

Lee, *March 5th*, 1928.

Tolerances on Poles.

I have recently been engaged on the erection of an overhead line involving the use of wooden and steel poles. Where these poles were for use as straight-line poles, that is to say, where three adjacent poles were in a true straight line, all was well.

Where the angle out of the straight exceeded, say, 3 or 4 degrees, trouble was experienced due to the component of the wires at right angles to the line.

I have been informed that it is usual in cases of this sort to design straight-line poles suitable for angles up to 5 or 6 degrees. I shall be glad if any of your readers will advise me whether this tolerance is really accepted practice, or whether a straight-line pole should be designed to withstand nothing but windage on the wires and the pole itself, excluding any transverse pull due to an angle.

Ergo (A.M.I.E.E.).

March 3rd, 1928.

Accumulator Tests.

I have followed with interest the correspondence and your impartial and constructive comments regarding the above, since your issue of September 3rd, 1926.

It is quite obvious that Mr. Clarke, from his letter in your issue of the 24th ult., has never had an accumulator with unknown characteristics sent to him to test for efficiency with a time limit on the instructions; otherwise he would have welcomed the "Tungstone" method of testing, and given them credit for making a distinct and bold step forward by raising a question which is, and always has been, subject matter for discussion.

Even if the efficiencies obtained by this method are not acceptable, because they do not "represent the ordinary service conditions," the method certainly rapidly gives a datum line, after which it is easy to carry out the "acceptable" efficiency tests favoured by Mr. Clarke, by recharging the accumulator up to a point represented by the relation between 100 per cent. and the efficiency obtained.

The subsequent discharge and any further cycles of charge and discharge will not have a diminishing characteristic, and will certainly conform closely to Wade's axiom, and furthermore *the efficiencies will be very near to those previously recorded* on the former method.

Mr. Clarke's prejudiced attack upon Tungstone's "advertising volubility" is quite uncalled for, as pioneering work of this nature may possibly lead to the establishment of definite conclusions and facts on this problem, and thus make for advancement and increased accumulator knowledge, which will be of value to the technicians and the larger army of laymen.

Also, their policy of having their motor-car starter battery tested independently by the National Physical Laboratory, and their boldness in publishing the results, proves even to "the man in the street" that they have confidence in their product; and, as far as my knowledge goes, no other maker has had such an independent test.

W. H. Exley.

Pontefract, *March 3rd*, 1928.

This interesting subject seems to be too complex to enable a satisfactory standard test to be devised to meet each case of the various types of lead-acid accumulator, owing largely to their construction for different usages.

A laboratory test for ampere-hour efficiency of a battery, as used, for instance, for motive power, or even radio purposes, is very misleading if used for advertising purposes, and under actual service conditions would not be possible of attainment for many reasons.

Efficiency figures for any make of battery to-day are valueless to users, *unless the makers will guarantee them for, say, twelve months after date of putting into service.* Where is the maker ready to do this for such a class of battery? He knows too well the inherent defects, either introduced or derived from the materials used in their final construction, which have to be contended with—and for which he would have to be responsible—that would just knock the bottom out of any laboratory test.

Yet it is on these lines that a standard test should be worked out, since it would aim at improved durability and increased commercial efficiency, and that, after all, is what really matters. It would also tend to create a more active research into the technical difficulties yet to be overcome to make the storage battery more of a commercial proposition for some classes of work.

With regard to the Tungstone Company's test figures that recently appeared in the daily Press in advertisement form, presumably these were obtained from a battery used for car-starting purposes. "Startling" as the figures appeared, it would have been much *fairer* to the non-technical general public to have carried the cycles of charges and discharges further to, say, thirty in number, and to have published the results obtained for each cycle in both ampere-hours and watt-hours per pound of total weight. What "startling" results would then have appeared!!!

I state the number of cycles at thirty, because I fear the efficiency would by then have reached somewhere about "nil value." The watt-hours per pound of total weight would give an intending user some idea of the commercial value for the weight he would have to carry.

H. H. Burford.

Four Oaks, nr. Birmingham,
March 3rd, 1928.

Impregnation of Insulation.

Referring to the letter under the above heading in the "Correspondence" columns of the current issue of the Electrical Review, I am very pleased to note that Mr. Brown is in such complete agreement with me on the views expressed therein, *viz.*, that good impregnation of electrical windings is impossible without a thorough drying-out in a vacuum, and subsequent impregnation under pressure.

In the article in question, I, of course, made no attempt to treat exhaustively the whole subject, methods of heating, &c., but I am glad to see that Mr. Brown advocates oil heating. This method of heat transmission is by no means the novelty that Mr. Brown appears to think it is, because over 22 patents have been taken out in this connection, and the M.A.X.E.I. Co. alone has put down over 200 installations of its oil-heated plant in various countries, including England (where the system is patented) since 1918.

The advantages of oil heating depend on the correct design of the apparatus, and the M.A.X.E.I. system possesses the following advantages besides those mentioned by Mr. Brown:—

The practically indefinite conservation of the first filling of oil, and this without a trace of oxidisation.

Extremely practical and convenient method of filling up the heating circuit with oil.

Automatic compensation for the expansion of the oil when heated.

Complete avoidance of local overheating.

Entire absence of danger from fire.

Again, the intricate processes involved in the impregnation of wood, cardboard, &c., with synthetic resin (which are patented in England by the M.A.X.E.I. Co.) were not touched on by me, as they are outside the scope of the article in question.

I may point out here, however, that two large factories

have recently been put to work in France, and one in Italy, using the M.A.X.E.I. process under licence, for the impregnation of wood and cardboard articles with synthetic resin.

Referring to Mr. Brown's remarks about obtaining knowledge of the amount of moisture in the windings, the best method of knowing exactly when all the moisture has been extracted is by using a condenser as supplied on the M.A.X.E.I. plants, to condense the extracted vapour, and observe the flow of condensate; another method is to test the windings electrically.

I am not surprised that the patents covering the admission of oxygen or ozone during the impregnating process were allowed to lapse, as I consider this to be most undesirable.

The M.A.X.E.I. patented process mentioned in my article consists in the complete separation of the two distinct operations of evaporation and oxidisation, in such a manner as to carry out the evaporation rapidly, but without fear of oxidisation, and finally to oxidise the varnish rapidly and thoroughly even to the centre of the winding, by regulating suitably the admission of air.

Windings treated in this way will be immune from the harmful action of hot oil.

A. C. Dunlap.

London, *March 7th*, 1928

The First Bowl Fitting.

Some time ago, in the course of a conversation with a well-known consulting engineer, the question arose as to the date when the first bowl fitting came into being in this country.

My friend mentioned the year 1891; my impression is that he was wrong. It may be a matter of interest to your readers to learn that in the year 1887, when electric light was being installed at the Marlborough Club (the late King Edward, then Prince of Wales, being the president), during one afternoon the Prince visited the Club whilst the installation work was proceeding. Several proposals were placed before him by the secretary, Captain Stone, as to the lighting of a room where the ceiling had been painted to represent the sky, having a number of stars dotted about it. Each of the proposals was rejected. Within the hearing of the writer the Prince stated definitely that he wanted a cut-glass bowl fitting fixed to the centre of the ceiling, with lamps inside to throw the light upwards.

Mr. Robert Richie, of Messrs. Thompson & Richie, representing the contractors, took the particulars. The fitting was made and fixed, and may be there to-day for all I know.

A. Champion,

Late Inspector, Electric Lighting Acts and Orders, London County Council.

London, *March 12th*, 1928.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1926.

20,533. "Electrical service devices particularly intended for household purposes." R. Lomax. August 20th, 1926 (285,517.)

23,086. "Control of the lighting system and glare-prevention devices on motor vehicles and the like." W. M. Harrison. September 18th, 1926. (Cognate applications 30,979/26 and 32,230/26.) (285,519.)

23,681. "Speaking tube attachments for telephones and like instruments." D. S. S. Steuart. August 18th, 1926. (Divided application on 274,525.) (Addition to 281,801.) (285,522.)

24,856. "Device for relieving the terminals in connections and couplings for electric conductors, which are moved about freely, from tension and pressure strains." J. Jerike. October 6th, 1926. (Convention date not granted.) (259,587.)

26,228. "Electrical air-core transformers." Edison Swan Electric Co., Ltd., and L. H. Soundy. October 20th, 1926. (285,533.)

28,189. "Vacuum electric tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1926. (285,536.)

28,191. "Vacuum electric tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1926. (285,537.)

28,191. "Vacuum electric tube devices." F. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1926. (285,538.)

28,496. "Temporary connectors for stranded electric conductors." British Insulated Cables, Ltd., and T. H. Falconer. November 12th, 1926. (285,542.)

28,699. "Electric fuses." V. Hope. November 15th, 1926. (285,545.)

29,271. "Vapour-electric rectifiers." British Thomson-Houston Co., Ltd. November 19th, 1925. (261,768.)

29,655. "Control apparatus for electrical apparatus such as motors." C. T. Scarf, C. H. Last, S. Gowan and Metropolitan-Vickers Electrical Co., Ltd. November 23rd, 1926. (285,588.)

30,203. "Electrical devices based on out-of-balance currents and voltages." Compagnie pour la Fabrication des Compteurs et Material d'Usines à Gaz. December 23rd, 1925. (263,770.)

30,517. "Securing of electrical conductors to carbons." Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston. April 20th, 1926. (269,847.)

31,160. "Electrical heating devices." Measurement, Ltd., F. Thorp and G. Melville. December 8th 1926. (285,599.)

31,380. "Circuit arrangements for hunting switches in automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and A. E. Caswell. December 10th, 1926. (285,602.)

31,542. "Electric switches." General Electric Co., Ltd., and A. E. Angold. December 13th, 1926. (285,605.)

32,134. "Electrical testing devices." E. Ellis December 20th, 1926. (Cognate application 7,699/27.) (285,611.)

33,036. "Selectors for automatic and semi-automatic telephone systems." Telefon-Und Telegraphenbau-Ges., and R. Sienang. December 31st, 1926. (285,618.)

1927.

552. "Devices for indicating the level of the electrolyte in batteries." E. Elwess. January 7th, 1927. (285,622.)

875. "Electric lamps." J. Jones. January 11th, 1927. (285,624.)

1,860. "Carbon resistances." Naamlooze Vennootschap Machinerieen en Apparaten Fabrieken. February 10th, 1926. (265,946.)

2,305. "Permanent magnets." W. Holmes and Ferranti, Ltd. January 26th, 1927. (285,633.)

3,040. "Electrical wiring system." H. S. Walker. May 15th, 1926. (271,038.)

3,426 "Inductance and other coils for wireless, and holders therefor." C. W. Clarke and A. S. Clarke. February 7th, 1927. (285,639.)

5,722. "Wireless or like high-frequency transmission installations." L. Mellersh-Jackson (C. Lorenz Akt.-Ges.). March 1st, 1927. (285,654.)

6,710 "Commutators for dynamo-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. March 10th, 1927. (285,661.)

7,926. "Channel-forming apparatus for telephone and the like cables." J. A. Kirby.. March 2nd, 1927. (285,670.)

8,616. "Electrodes for electric welding or soldering." Alloy Welding Processes, Ltd., and E. J. Clarke. March 29th, 1927. (285,674.)

11,619. "Electrical heating apparatus for liquids." W. Y. Newland. May 2nd, 1927. (285,691.)

12,130. "Pivoting headlamps for vehicles." P. E. Gauchot. May 5th, 1927. (285,693.)

12,440. "Cable terminal box of plates of reinforced concrete or similar constructional material." W. Seifert and E. Seifert (trading as E. Seifert, firm of). May 9th, 1927. (285,694.)

13,069. "Clip and frame for application to an electric lamp bulb." T. H. Bolam and D. L. Jones. May 16th, 1927. (285,698.)

13,536. "Electrostatical vibration structures." E. Klar. May 21st, 1926. (271,494.)

14,724. "Controlling mechanism for elevators." British Thomson-Houston Co., Ltd. June 8th, 1926. (272,491.)

14,883. "Electric hoisting gear." W. E. Evans (Demag Akt.-Ges.). June 2nd, 1927. (285,704.)

15,390. "Electric heating blankets, coverlets, and the like." A. K. Watson and R. Millbourn. August 9th, 1926. (275,568.)

16,399. "Rectifying installations for alternating current" Naamlooze Vennootschap Philips' Gloeilampenfabricken. January 29th, 1927. (284,906.)

16,936. "Electric lampholders." J. B. Taunton. June 25th, 1927. (285,714.)

17,428. "Electric induction furnaces." Metropolitan-Vickers Electrical Co., Ltd. July 27th, 1926. (275,189.)

17,711. "Electric soldering irons." British Thomson-Houston Co., Ltd. July 6th, 1926. (274,077.)

17,965. "Arrangement in electrical hot-water cisterns for preventing loss of heat" Akt. Ges. Kummler & Matter. July 6th, 1926 (274,089.)

18,311. "Sound recording and reproducing." De Forest Phonofilms, Ltd. July 10th, 1926. (274,118.)

18,738. "Closed circulating cooler systems with external ventilating means for electric machines." Akt. Ges. Brown, Boveri et Cie. July 16th, 1926. (274,486.)

19,200. "Electric transformers for use as radio frequencies." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. July 19th, 1927. (285,723.)

20,666. "Electrical phase and frequency changers." International General Electric Co., Inc. August 6th, 1926. (275,643.)

20,670. "Head telephones." A. Reimer (*née* Korsinofski). August 5th, 1927. (285,733.)

20,871. "Reproduction of recorded sounds." De Forest Phonofilms, Ltd. August 8th, 1927. (September 11th, 1926.) (277,303.)

20,967. "Apparatus for making joints for electric cables." Soc. Italiana Pirelli. August 10th, 1926. (275,987.)

20,969. "Method of and means for producing optical images." Television, Ltd., and J. L. Baird. October 15th, 1926. (Divided application on 25,773/26.) (285,738.)

21,584. "High-frequency induction furnaces." International General Electric Co., Inc. August 19th, 1926. (276,351.)

22,394. "Combined picture projection and sound reproducing apparatus." De Forest Phonofilms, Ltd. September 11th, 1926 (277,314.)

23,675. "Electric hot-plates." H. H. Berry and W. J. Markham. September 8th, 1927. (285,751.)

28,063. "Safety arrangements for Röntgen apparatus." W. Otto. October 26th, 1926. (Addition to 278,757.) (279,838.)

28,072. "Brake gear for electric winches." Demag Akt. Ges. March 15th, 1927. (285,762.)

28,461. "Cooling systems for electrical transformers or other electrical apparatus." Metropolitan-Vickers Electrical Co., Ltd. October 28th, 1926. (279,859.)

28,641. "Production of high-frequency electric currents." C. Lorenz Akt. Ges. October 28th, 1926 (279,881.)

29,263. "Insulators." D. H. Rowland. November 19th, 1926. (280,894.)

29,264. "Insulators." C. B. Van Atta. November 26th, 1926. (281,245.)

33,806. "Electric remote-control apparatus for stop valves." Fabrique d'Appareils Electriques F. Sauter Soc. Anon. December 18th, 1926. (282,398.)

1928.

1,837. "Vacuum electric tube devices." E. Y. Robinson and Metropolitan-Vickers Electrical Co., Ltd. November 9th, 1926. (Divided application on 285,536.) (285,784.)

2,286. "Electric couplings." General Electric Co., Ltd., R. J. Kaula, and F. G. Quance. November 11th, 1926. (Divided application on 285,148.) (285,785.)

3,741. "Device for relieving the terminals in connections and couplings for electric conductors, which are moved about freely, from tension and pressure strains." J. Jerike. October 6th, 1926. (Divided application on 259,587.) (285,797.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from March 7th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

Kuprox. No. 485,193. Class 8. Battery charging rectifiers, radio battery eliminators, and parts therefor.—Kodel Radio Corporation, Cincinnati, U.S.A. (F. B. Dehn, 113, Kingsway, W.C.2.)

Helios Wond-erlamp (lettering and design). No. 485,028. Class 13. Electric lamps (ordinary).—E. J. Arnold, Dresden. (Hans & Danielsen, 321, St. John Street, E.C.1.)

Decorona. No. 487,518. Class 50. Shades for electric light, made of wood with silk or other similar decoration.—Specialities (Liverpool), Ltd., 9, Mount Pleasant, Liverpool.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHFORD (Middlesex).—189 houses, Park Estate; The Keystone Construction Co. 180 houses, Feltham Hill Road, for the Feltham Hill Building and Construction Co.; P. C. Gardener & Co., Hounslow.

AYRSHIRE.—New Marr college at Troon (£200,000).—J. Arthur, architect, Glasgow.

BARNOLDSWICK.—Memorial hall (£5,000); Supt. F. Widdup, St. John's Ambulance Brigade.

BEDFORD.—Joint mental hospital, Haynes Park; Bedford and Northants County Councils.

BEXHILL.—Houses, Barnhorn Road; Matthews & Co., architects.

BILSTON (Wolverhampton).—Additional housing scheme (372), for the U.D.C.; surveyor.

BIRMINGHAM.—Adaptation of "Sorrento" as maternity home (£6,000); City Medical Officer of Health. Extensions, Handsworth Grammar School (£10,000); governors.

BOLTON.—300 houses; borough engineer. Bank, Deansgate; Lloyd's Bank, Ltd.

BOURNEMOUTH.—Pier approach scheme (£40,000); borough engineer. Secondary school, Iford, for the Borough E.C.; F. W. Ibbett, director of education. School, for managers of St. Walburga's Catholic Schools; correspondent.

BRIDGEWATER.—Beet sugar factory (£300,000) for the Great Western Sugar Co.; Sir R. McAlpine & Sons, London, contractors.

BRIGHTON.—School (£43,200), Moulscombe, for the Borough E.C.; director of education.

BROMLEY (Kent).—Extensions, Cottage Hospital (£11,000), for the Committee; secretary.

BURNLEY.—Central public library, elementary school, Rosehill, and grammar school, for the T.C.; borough surveyor.

BURNHAM-ON-SEA.—Police court and magistrates' rooms for Somerset C.C.; A. J. Toomer, county architect, West Street, Weston-super-Mare.

CHELTENHAM.—68 houses, Folly Lane; Mr. Malvern, Corporation architect. Public offices, R.D.C.

CHIPPENHAM.—Housing scheme (30), for the R.D.C.; G. Parker Pearson, architect.

CHRISTCHURCH (Hants).—Infirmary extensions for the B.G.; W. J. Dacombe, architect, Lloyd's Bank Chambers, Boscombe, Bournemouth.

CLACTON-ON-SEA.—Baptist church (£9,000); Rev. D. Hayes, Pier Avenue Church.

CLANFIELD.—School (£6,000), for the Hants. Education Committee; director of education, Winchester.

COLESHILL (Coventry).—Houses (48), for J. C. Payne, Ltd.

COVE.—School (£6,709), for Hants. Education Committee; Director of Education, Winchester.

DAGENHAM (Essex).—Central fire station (£6,000), for the U.D.C.; surveyor.

DONCASTER.—Additional 200 houses, for the T.C.; borough surveyor.

EASTBOURNE.—Extensions, Highway Depôt; Indented Bar and Concrete Engineering Co. Internal alterations, Eye Hospital; trustees. Additions, Hydro Hotel, Mount Road; F. G. Cooke, architect. Alterations, Langham Hotel, Royal Parade; A. Ford, architect. 54 houses, Martello Estate; W. J. Simms, Son & Cook.

EAST AND WEST MOLESEY.—Housing scheme (60), for the U.D.C.; surveyor.

ERITH.—Research buildings, for Callender's Cable and Construction Co., Ltd.

FALKIRK.—Conversion of Old High School into Mining Centre (£2 928); Mr. G. Blane, executive officer, Stirlingshire Education Authority, Stirling.

FALMOUTH.—146 houses and flats at Penwerris; Jose and Sons, builders, Redruth.

GILLINGHAM (Kent).—Housing scheme (110), for the T.C.; J. L. Redfern, borough engineer.

GLASGOW.—Premises for Scottish Grain Distilling Co., Ltd., Waddell Street; N. Macwhannell, architect.

HIGHAM (Rochester).—Works, for the British Uralite and Cellactite Co.; Mr. King, manager.

ILKESTON.—Extension, printing works, Cotmanhay Road; L. Buxton.

JEDBURGH.—Artificial silk factory, North British Artificial Silk, Ltd.

KENDAL.—Post Office with electrical work, for H.M. Office of Works; C. P. Wilkinson, architect. Woof Cronshaw and Sons, Ltd., builders, Blackburn.

KINGSTON-ON-THAMES.—120 houses, Cambridge Road, Norbiton, for the T.C.; borough surveyor.

LANCASTER.—Extension of the Royal Infirmary (£70,000); secretary. 200 houses, two new sites; borough engineer.

LEEDS.—Extensions, Maternity Hospital (£5,000); Medical Officer of Health.

LITTLE HULTON.—Housing schemes, Worsley Road (44); Armitage Avenue (48); surveyor to U.D.C.

LLANGOLLEN.—Roman Catholic church; Rev. Father Moran, M.C., parish priest.

LONDON (E.C.).—Rebuilding 140-144, Leadenhall Street; Midland Bank, Ltd.

(Barking, E.).—Houses (198) and flats for the U.D.C.; Sherren, Ltd., builders.

(East Ham, E.).—Extension, foundry, Forest View Road; C. Binks. Extensions, Isolation Hospital; Medical Officer of Health.

(Ilford, E.).—Central school, Ley Street; Education Committee. Isolation hospital; borough engineer.

(Spitalfields, E.).—Two blocks of shops, Bell Lane area; L.C.C. architect.

(Tooting, S.W.).—Laboratory, Tooting Bec Hospital; Metropolitan Asylums Board.

(Wimbledon, S.W.).—Machinery store, Kingston Road; Lysol, Ltd.

MANSFIELD.—Additional 200 houses and fire station, for the T.C.; borough surveyor.

MICKLEOVER.—100-bed admission hospital, Mental Hospital, for Derby C.C.; G. H. Widdows, architect, St. Mary's Gate, Derby.

NEWTON-IN-MAKERFIELD.—Secondary school (£38,038), for Lancashire E.C.; education architect, Preston.

NORTHAMPTON.—Extensions, factory, Far Cotton; Crown Foundry Co., Ltd. Machine room, St. Mary's Street; Xpress Printers, Ltd. Extensions, printing department, 25, The Drapery; W. Marks & Co., Ltd.

PETERBOROUGH.—Additional housing scheme (250), for the T.C.; borough surveyor.

RETFORD.—Casual wards (£6,128), for the B.G.; John Swannack, builder.

ROCHDALE.—Housing scheme (390), Nook Estate (deposit £2 2s.); S. H. Morgan, borough engineer.

ROTHERHAM.—Glassworks extensions, Beatson, Clark and Co., Ltd.

SALFORD.—66 houses, Littleton Road; C. Swain, architect.

SANDOWN.—Roman Catholic church, presbytery and parish hall, Rev. Father Flynn, Somerset House.

SCARBOROUGH.—Housing scheme (100), for the T.C.; borough surveyor.

SHEFFIELD.—Library, Firth Park (£14,645); W. Marlow and Sons, Ltd. Retail market, Castle Hill (£40,000); city engineer.

SKIPTON.—Hospital extensions (£5,000); Hospital Committee, U.D.C.

SOUTHAMPTON.—Town Hall, municipal offices, art gallery, courts, and police headquarters, for the T.C.; Town Hall Committee.

STRETFORD.—Municipal offices, Talbot Road; U.D.C. Extensions, works, Elsinore Road; Wardle Engineering Co., Ltd. Workshop, Ashburton Road; F. E. Gill & Sons.

SUTTON (Surrey).—Houses (86), Sutton Common Road, for Fowles & Finch. Houses (164), London and Provincial Building Co.

TOTTON.—Mixed school (£6,150), for Hants. E.C.; director of education, Winchester.

WAKEFIELD.—Extensions, Museum and Art Gallery; city engineer.

WARRINGTON.—Municipal offices; Special Corporation Committee.

WEDNESFIELD.—Works, Neachels Lane, for Jenks & Cattell, washer manufacturers, Deans Road, Wolverhampton.

WIRRAL.—Hospital extensions (£57,542), for the Joint Hospital Board; J. A. Milestone & Son, builders, Wallasey.

WOLSTANTON.—Additional 50 houses for the U.D.C.; surveyor.

WOLVERHAMPTON.—Extensions, grammar school (£20,000), for the governors; secretary.